

22 Nov 93

A REPORT
CONCERNING THE
MARATHWADA
EARTHQUAKE

Laurie Baker

OCT 1993.

TO BE

There has been an Earthquake & about 20,000 families are now home less.

Relief work has been Commendably Swift and Thorough, thanks to all concerned.

Now lies before us the task of giving permanent rehabilitation.

This cannot reasonably be done at the same speed as the relief work.

Will there be more earthquakes and how can we plan to live with them?

30 to 40% of the area is on Laterite. There is Black Cotton Soil elsewhere but mainly it is only a foot or two deep & lying on top of hard rock.

Towns are not affected. Most of the damage is in scattered villages - some quite big.

Peoples' life style is almost entirely rural & concerns the growing of grain, sugar cane, sunflowers etc.

There is plenty of cattle, goats, sheep & poultry.

Over hundreds of years a suitable home plan has evolved.

The main living area is an open Courtyard. It is enclosed by a high wall for privacy & security (especially for animals)

Rooms lie along the perimeter of the yard - the compound wall being the back wall of rooms, verandahs & work areas & cattle sheds.

OR NOT TO BE ?

Should we take this opportunity to upgrade traditional housing? It has not been able to stand up to the fury of the earthquake.

Does the local life-style need changing, & with it the plan & design of the house?

Is there any good reason for breaking with tradition & indigenous practices by introducing a new way of living and a 'modern' type of housing & 'town' planning?

After staying in the area, surveying conditions & finding out the opinions of the local people, the writer of this report found no evidence or desire to abandon the extremely good farming life (oil seeds etc) nor did anyone think of abandoning their cattle, goats, sheep & poultry.

Similarly, most wanted their ~~comp~~ enclosed, walled, compound plan to be retained.

In the "West" a "new fashion" is to develop 'neighbourhoods' - clusters of houses around a non-traffic 'village green'. Little do they realise that this is the established Indian Rural pattern of 'town' planning!

'Neighbourhoods' are quite different from 'parks' or recreation grounds.

Here people chat, draw water, 'park' their bullocks & bullock carts; Children play. Goats & hens 'free range'.

Surely this longstanding, well proved system of rural planning should not be terminated & the new, road side 'nagar' system take over?

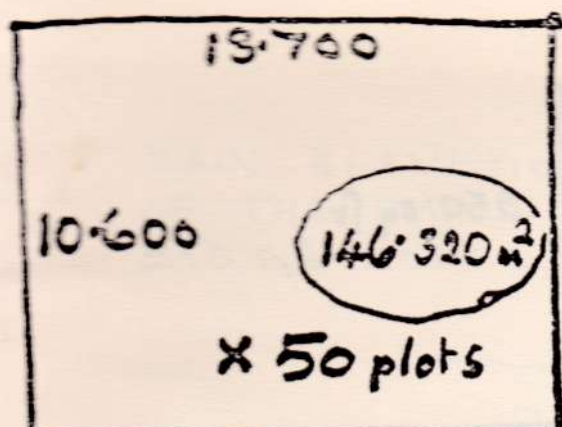
The 'Report' tries to compare these 2 systems.



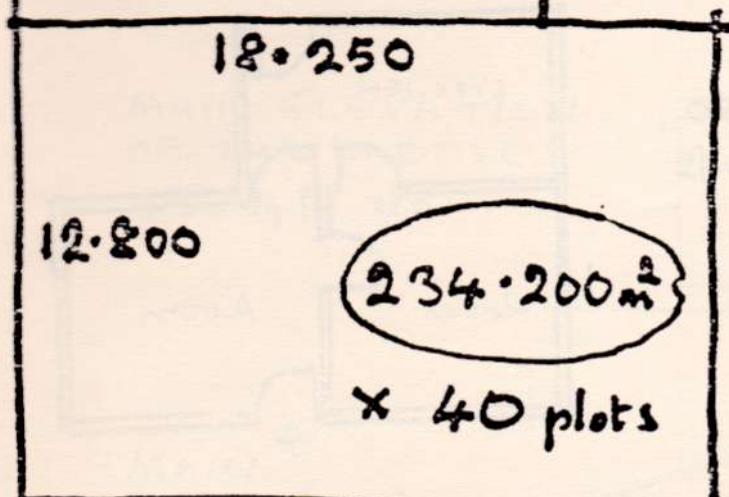
PROPOSED ?

DISPOSED !

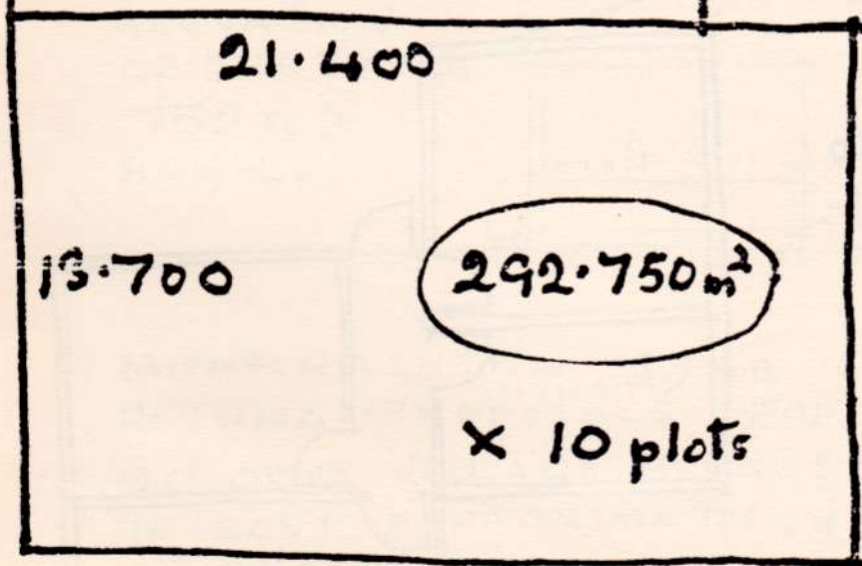




$$= 731.600 \text{ m}^2$$

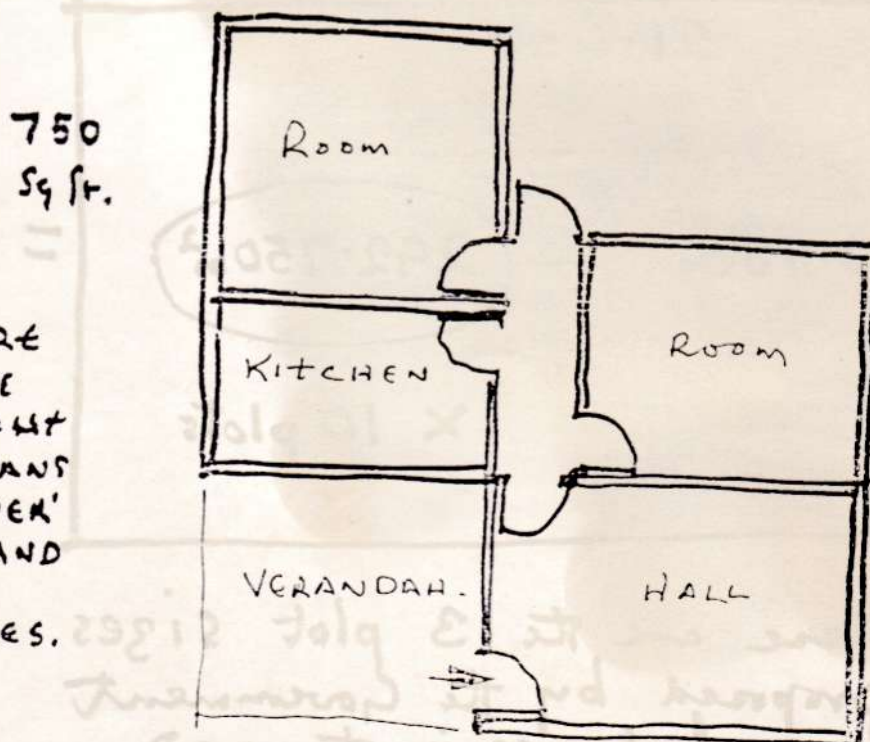
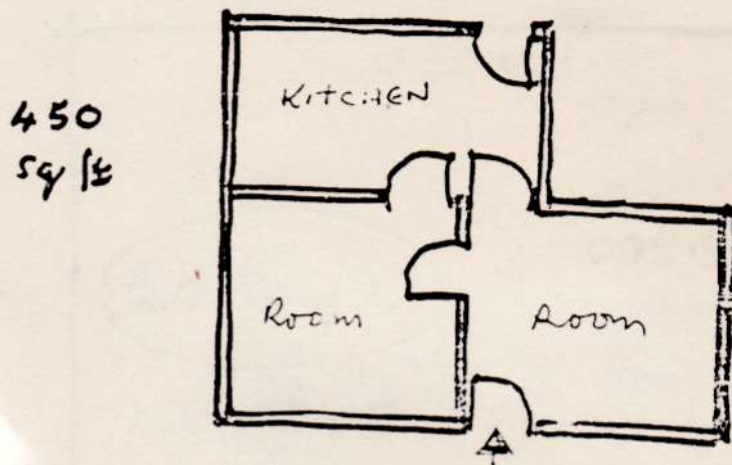
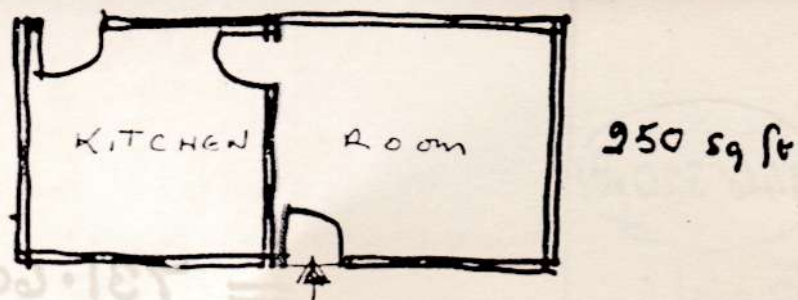


$$= 936.680 \text{ m}^2$$



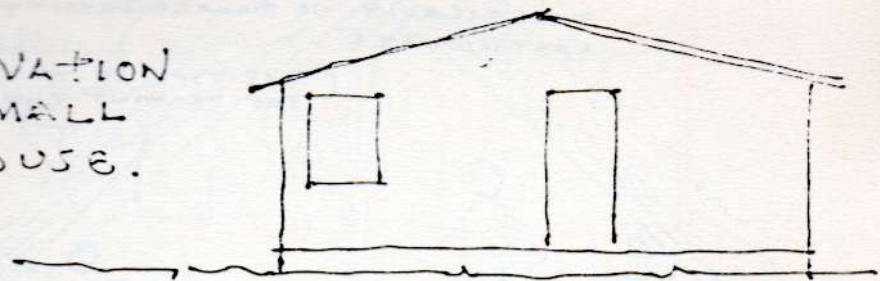
$$= 2927.500 \text{ m}^2$$

these are the 3 plot sizes
proposed by the Government
for each house in the new
villages

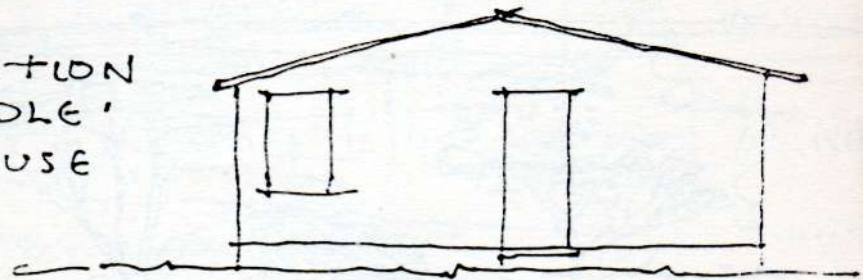


THESE ARE
THE THREE
GOVERNMENT
HOUSE PLANS
FOR 'UPPER'
'MIDDLE' AND
'LOWER'
CATEGORIES.

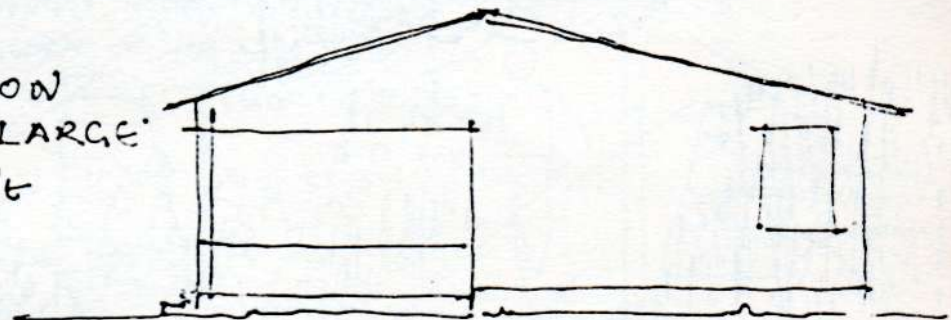
MAIN ELEVATION
OF THE SMALL
250 sq ft HOUSE.



MAIN ELEVATION
OF THE 'MIDDLE'
450 sq ft HOUSE



MAIN
ELEVATION
OF THE 'LARGE'
750 sq ft
HOUSE.



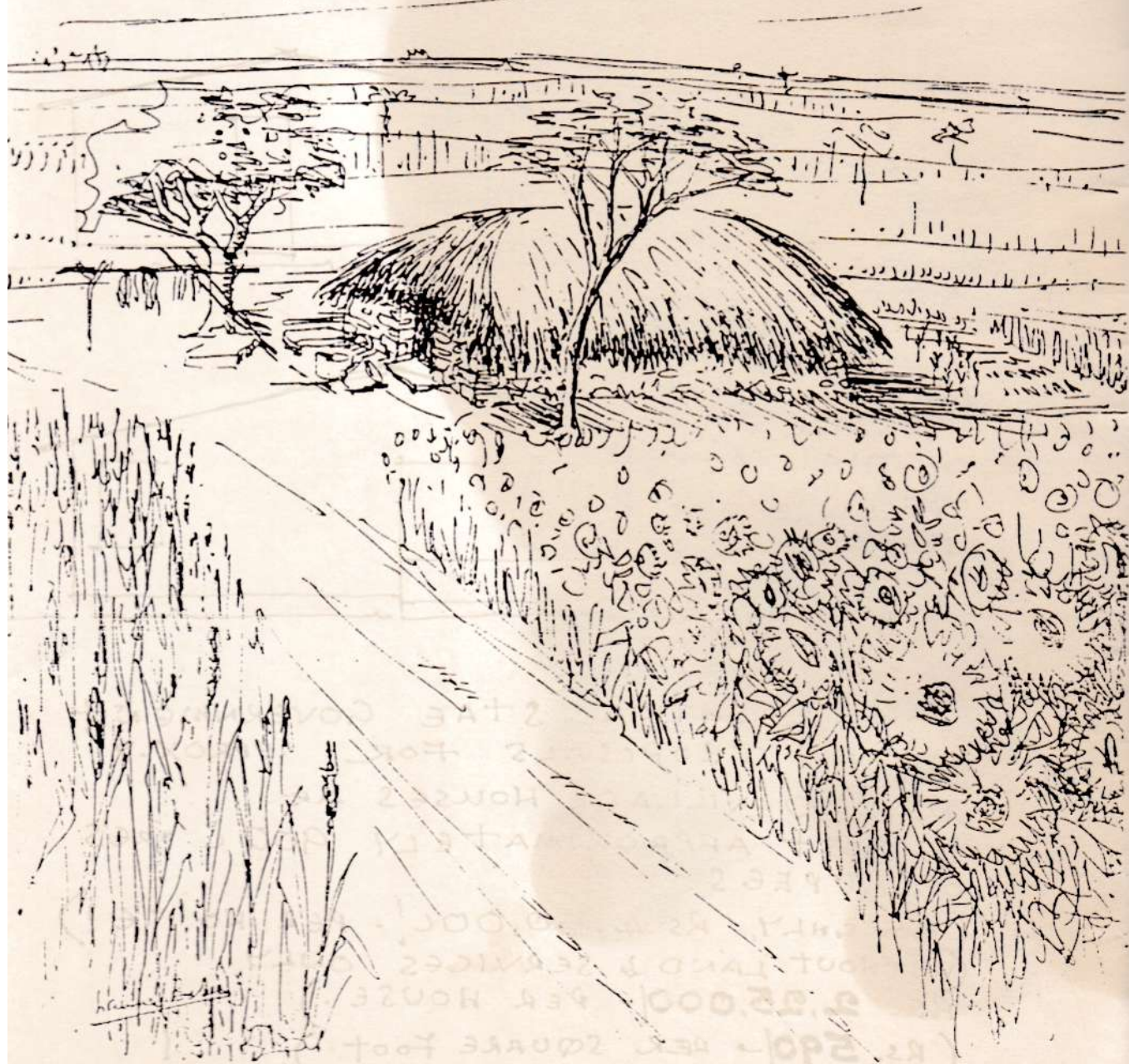
MAHARASHTRA STATE GOVERNMENT
HOUSING PROPOSALS FOR APPROX. 20,000 VILLAGE HOUSES ARE
TO COST APPROXIMATELY 900 CRORES
OF RUPEES.

(ROUGHLY RS 4,50,000/- PER HOUSE!)
(WITHOUT LAND & SERVICES ONLY
RS **2,25,000/-** PER HOUSE.)
(RS. **590/-** PER SQUARE FOOT). !

A TYPICAL FIELD HOUSE

PRACTICALLY NO DAMAGE FROM THE
EARTHQUAKE

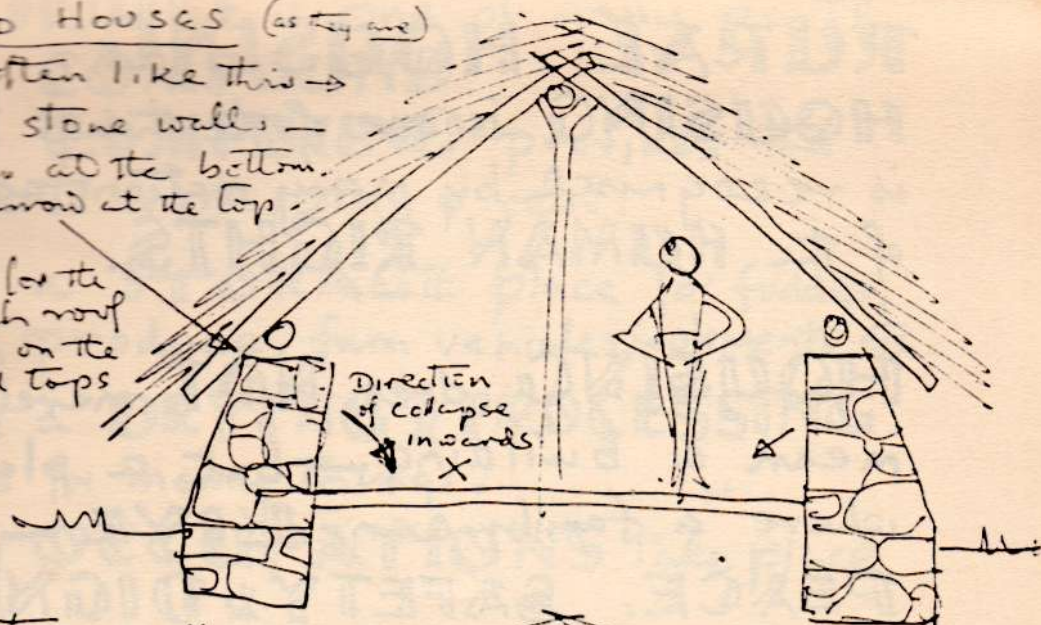
(THIS TYPE OF HOUSE IS MORE FOR
THE TENANT CUM CHOWKIDHAR.)



Field Houses (as they are)

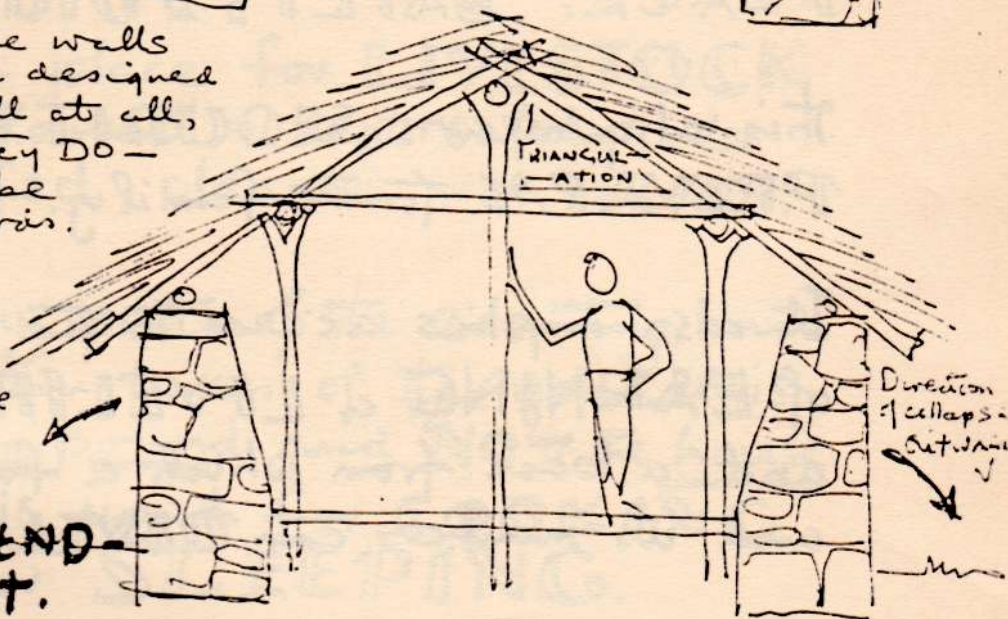
are often like this →
Low stone walls —
 wider at the bottom
 & narrow at the top.

Poles for the
 thatch roof
 rest on the
 wall tops



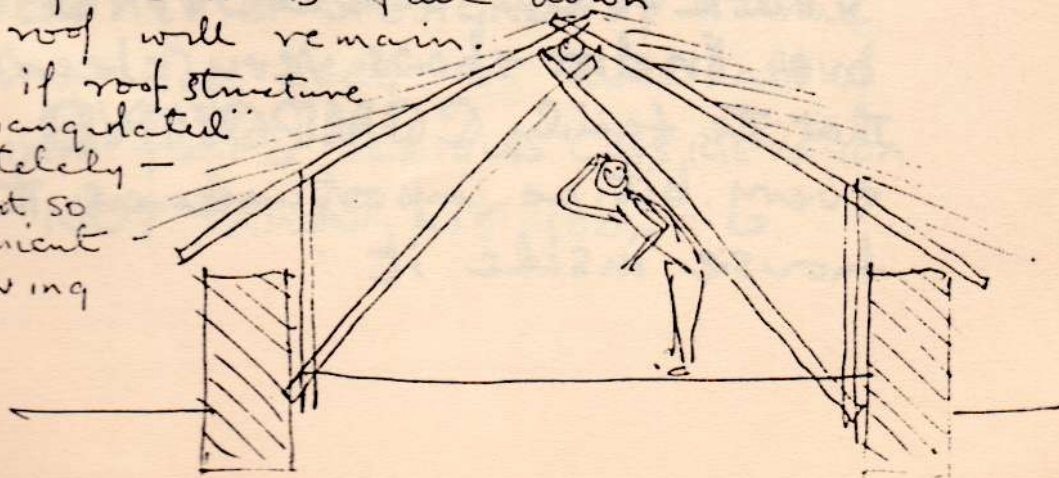
The stone walls
 can be designed
 not to fall at all,
 but if they DO —
 it will be
 outwards.

The roof
 structure
**MUST
 BE
 INDEPEND-
 -ENT.**



Even if the walls fall down
 The roof will remain.

Better if roof structure
 is "triangulated"
 completely —
 but not so
 convenient —
 for living



RURAL HOUSING.

HOUSING is one of the things that is recognised by many nations as one of the HUMAN RIGHTS.

'HOUSING' does NOT merely mean a building — but a place where a family can LOVE — in PEACE, SAFETY & DIGNITY

This also means SECURITY and PRIVACY for the family.

It also implies access to the means of EARNING a LIVELIHOOD, and a base from which a family and its members can DEVELOP.

VILLAGE HOUSING all over India shows very clearly that the family COMPOUND is every bit as important as the house inside it

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The HOUSE is one of many parts of the COMPOUND.

The COMPOUND provides the space to work, play & rest.

It is a STORAGE place for fodder, fuel, produce, farm vehicles, implements etc.

It is a DRYING & PROCESSING place for many things.

Many OCCUPATIONS take place in it.

It is a place for LIVESTOCK to be 'housed' & kept safely, also to be fed, cleaned, reared etc.

In many parts of the country, and at certain times of the year, it is the compound and NOT the house which is used for COOKING and for SLEEPING.

A planner or designer of rural housing who does not take all of this into full & serious consideration does NOT know his job.

ENCLOSING the COMPOUND
is an Essential.

It may be by a hedge, a live
fence, fencing, palings, wire. etc.
Some of these may provide safety, but
not privacy.

In MARATHIWADA the ideal
enclosure has been a solid wall,
built from LOCALLY AVAILABLE
material — STONE in one area
and LATERITE in another.

Unfortunately it has often been
built by the occupants themselves,
without their knowing the required
principles of stone masonry
construction. Without BONDING
(see elsewhere) many of these
walls fell down in the earthquake.

There are simple methods of building
these walls so that they will NOT
fall down, & slightly more complex
methods making use of reinforcement.

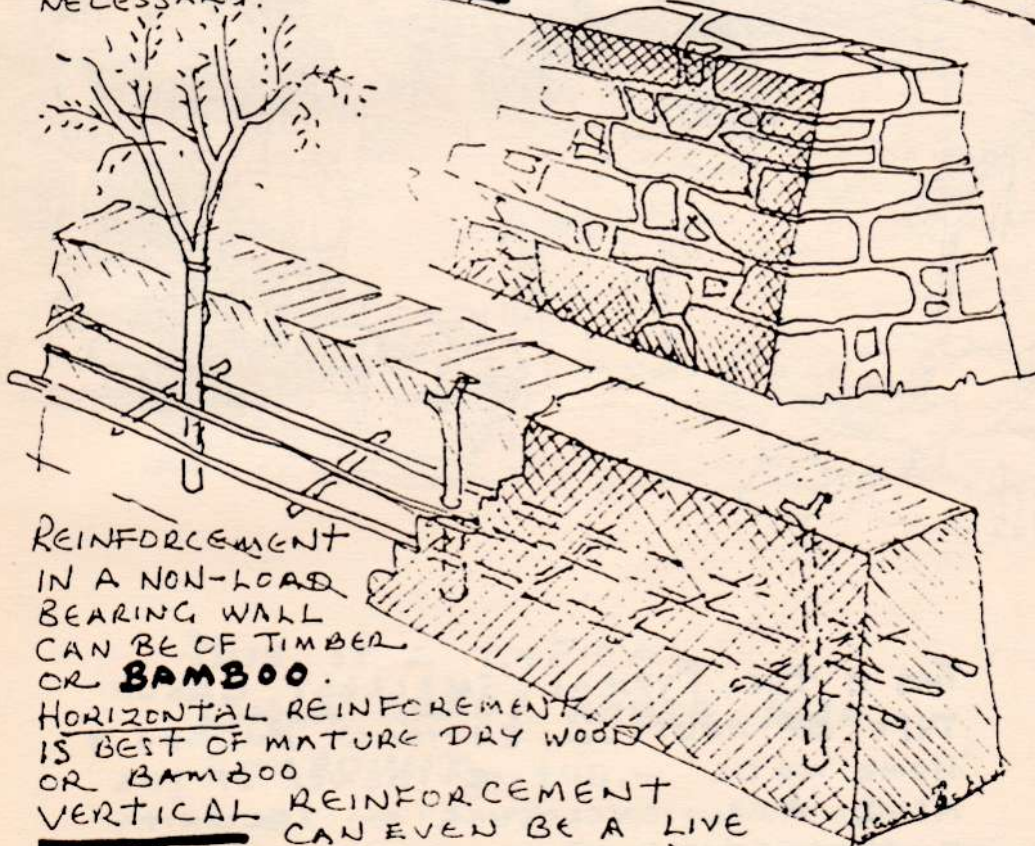
PROPER BONDING OF STONE IS LIKE THIS

IF IT IS PROPERLY DONE
IT CAN EVEN BE A "DRY WALL"
BUT USUALLY MORTAR IS USED
(BUT FOR STABILITY ONE MUST
NOT RELY ON MORTAR)

(BONDING IS LIKE
THE CLASPING OF
HANDS)

A 'BATTERED' WALL

IS LESS LIKELY TO
FALL DOWN —
BUT BONDING IS STILL
NECESSARY.

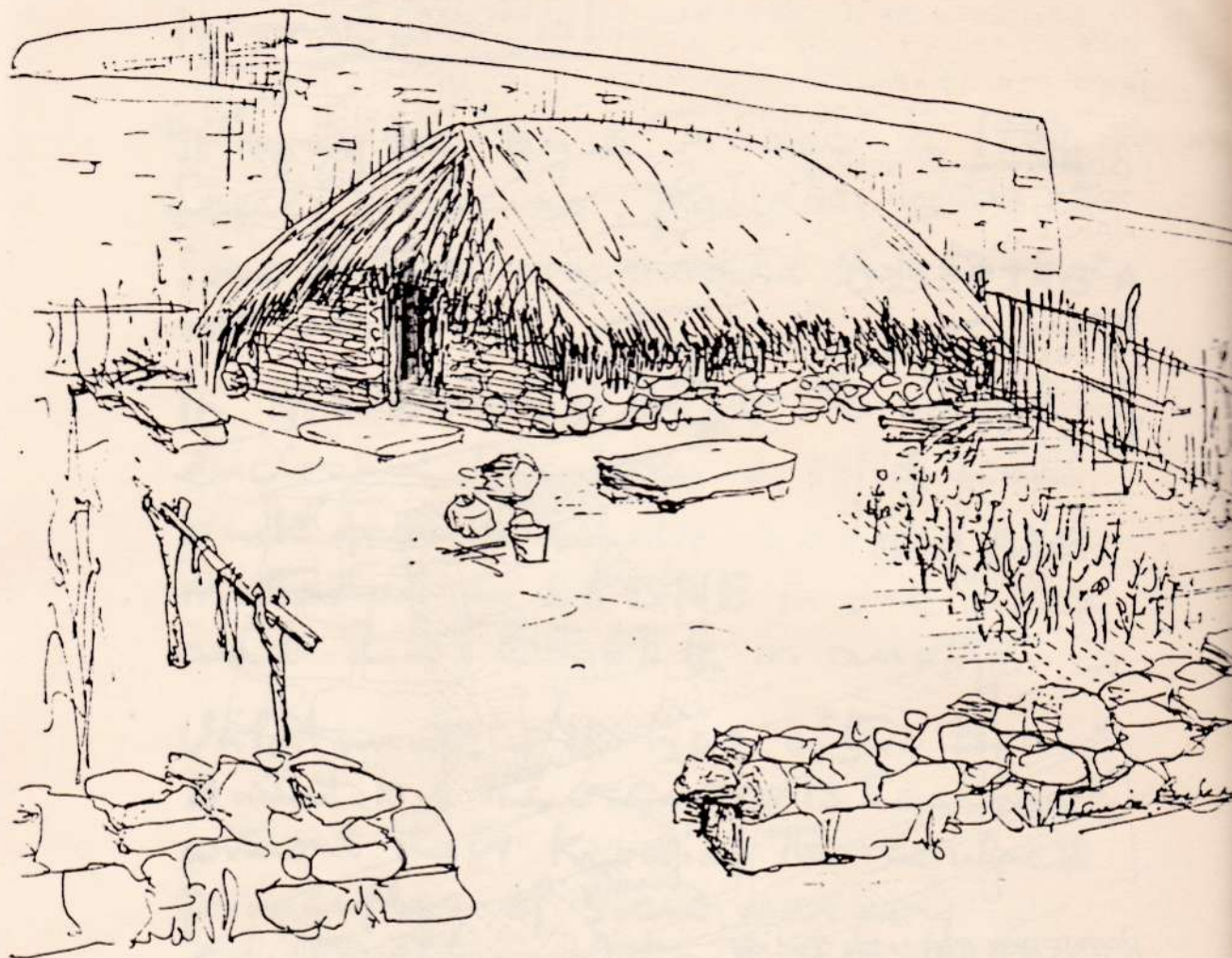


REINFORCEMENT
IN A NON-LOAD
BEARING WALL
CAN BE OF TIMBER
OR **BAMBOO**.

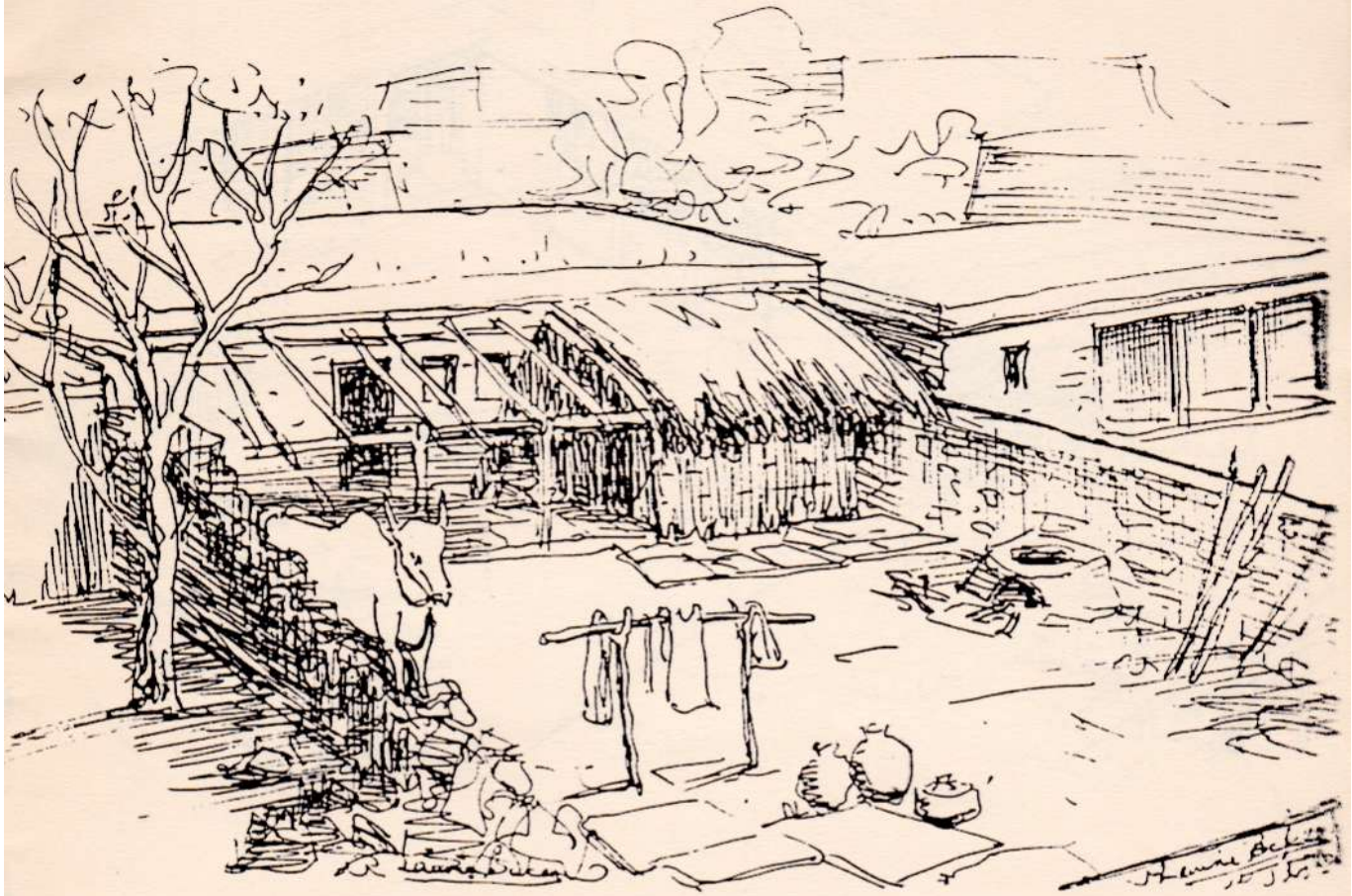
HORIZONTAL REINFORCEMENT
IS BEST OF MATURE DRY WOOD
OR BAMBOO

VERTICAL REINFORCEMENT
CAN EVEN BE A LIVE
PLANT (SUCH AS GLYRICIDIA)

STEEL IS NOT THE ONLY FORM OF REINFORCEMENT.

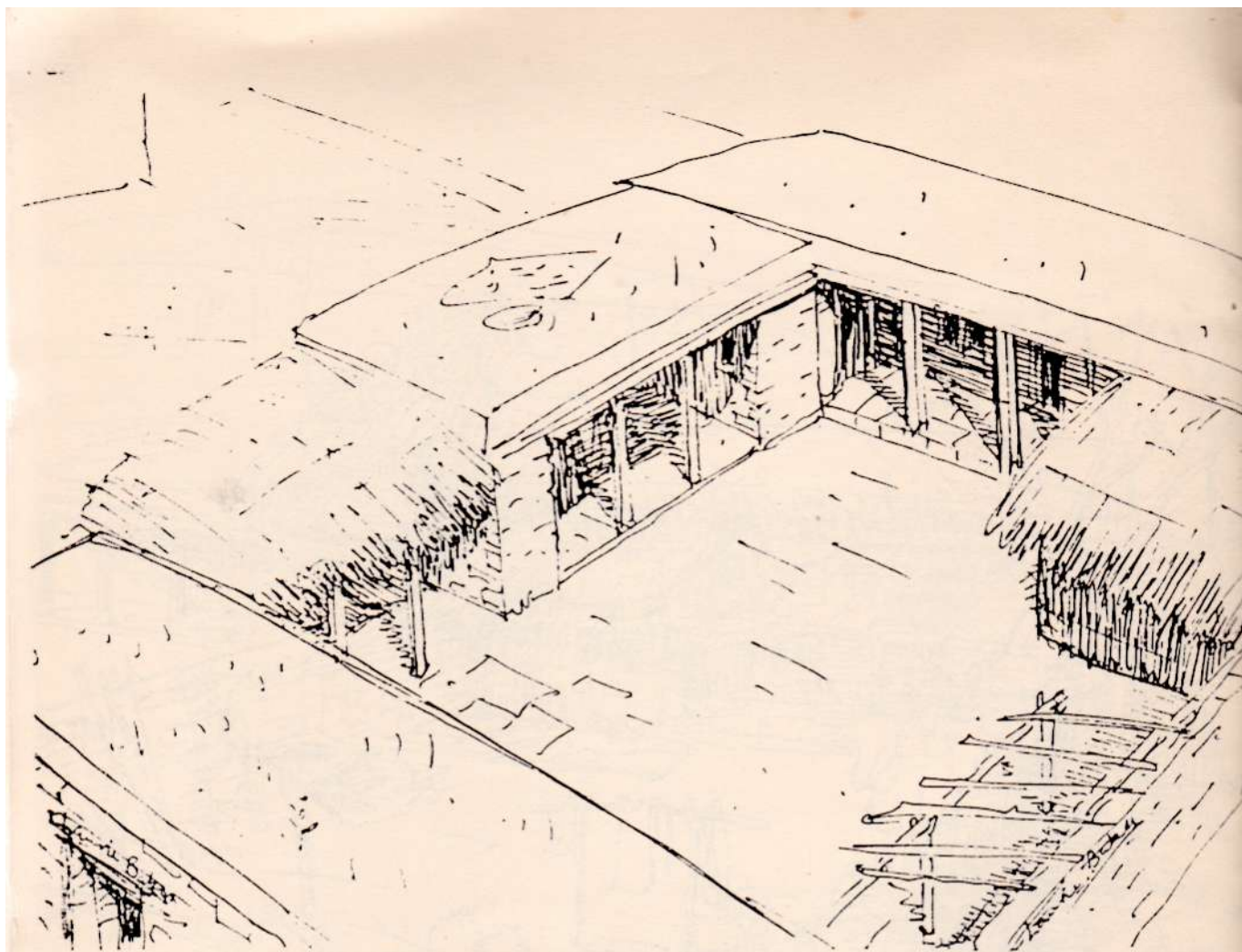


THIS IS THE TYPICAL 'SMALLEST' GROUP
TYPE OF HOUSE — ENTIRELY KUCCHA &
'HOME MADE' — BUT EVIDENCE OF THE
NEED FOR ENCLOSURE & 'SECURITY'
& COLLECTION OF MATERIAL FOR
FUTURE GROWTH & IMPROVEMENT.

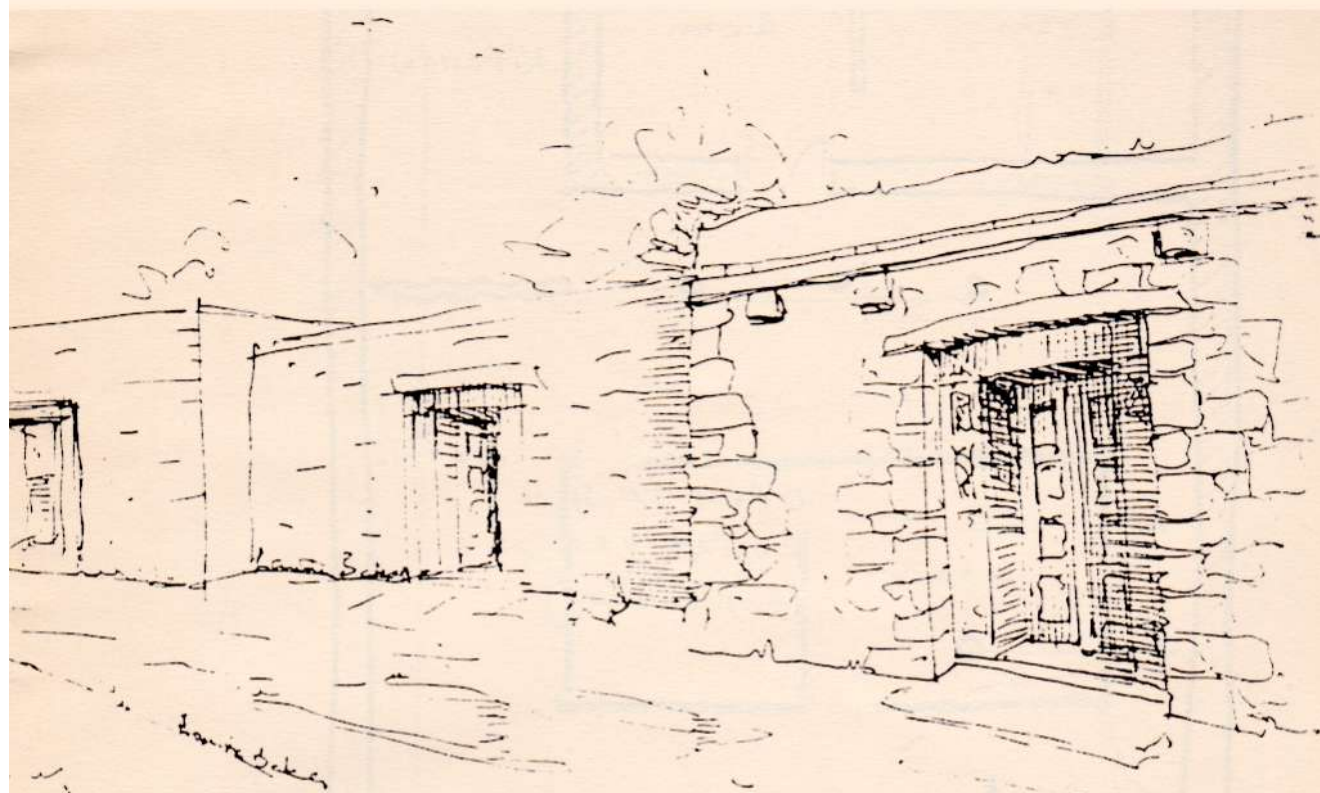


THIS IS A TYPICAL
'LOWER' GROUP HOUSE AND
COMPOUND.

A BIT OF PUKKA CONSTRUCTION
AND PLENTY OF KUCCHA ADDITIONS

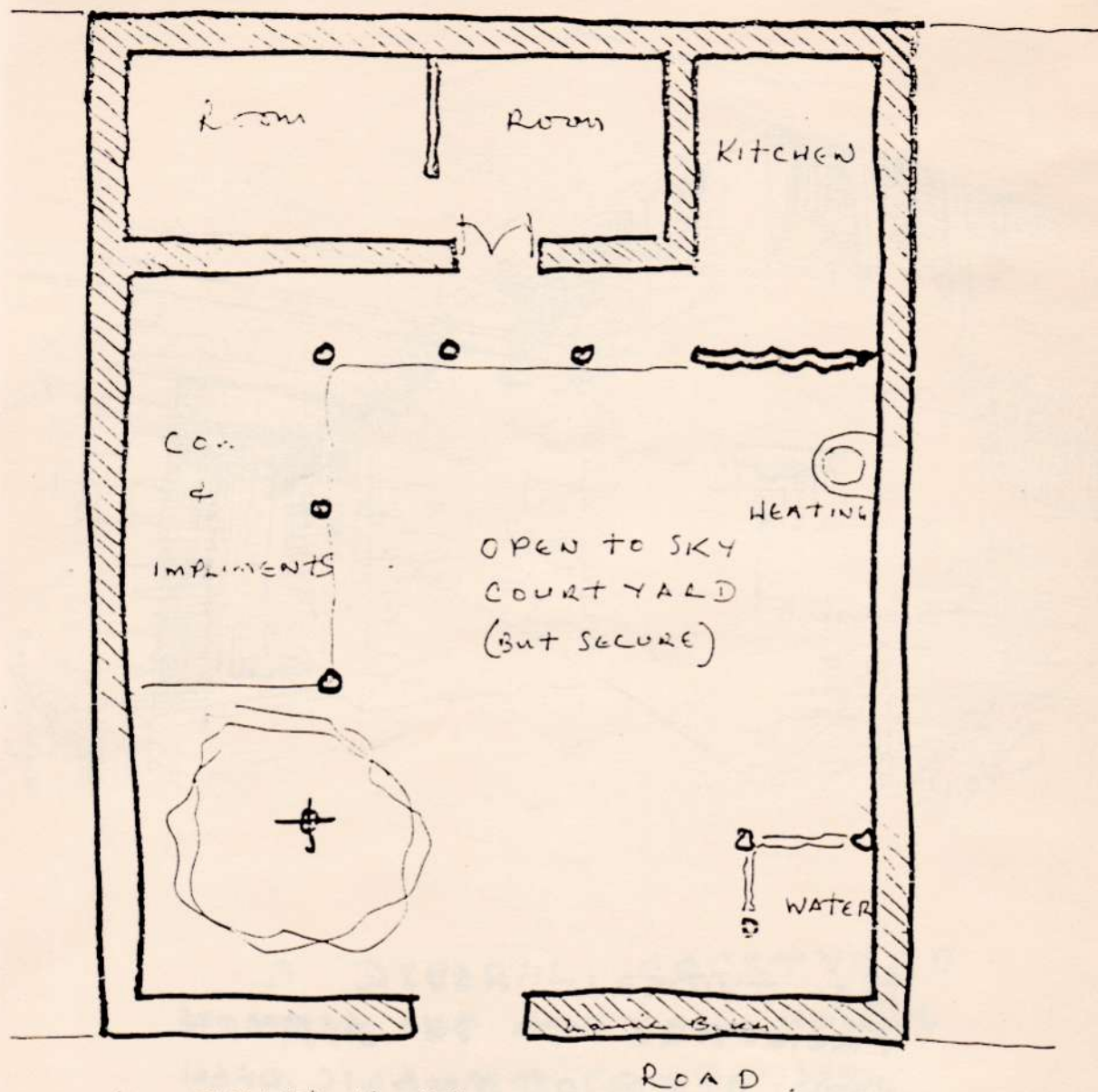


A TYPICAL COURTYARD
TYPE OF EXISTING HOUSE
& ENTIRE COMPOUND.



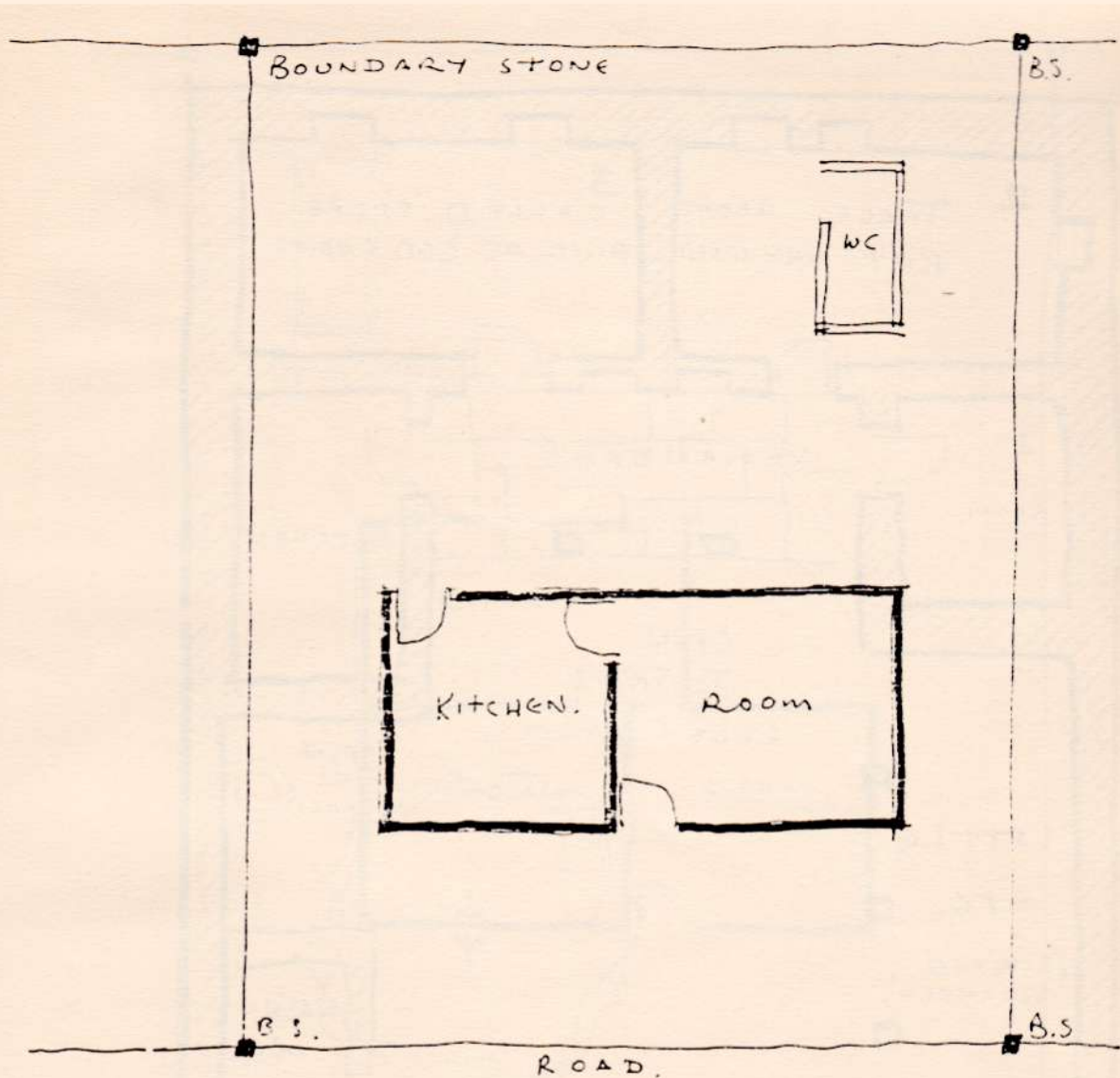
THE TYPICAL HOUSE
FRONTAGE TO THE COMMON
PATH, ROAD, OR PUBLIC OPEN
GROUND.

THE DESIRE FOR PRIVACY &
SECURITY — "this is my private
property" found everywhere
except in the open fields is very
clearly obvious.



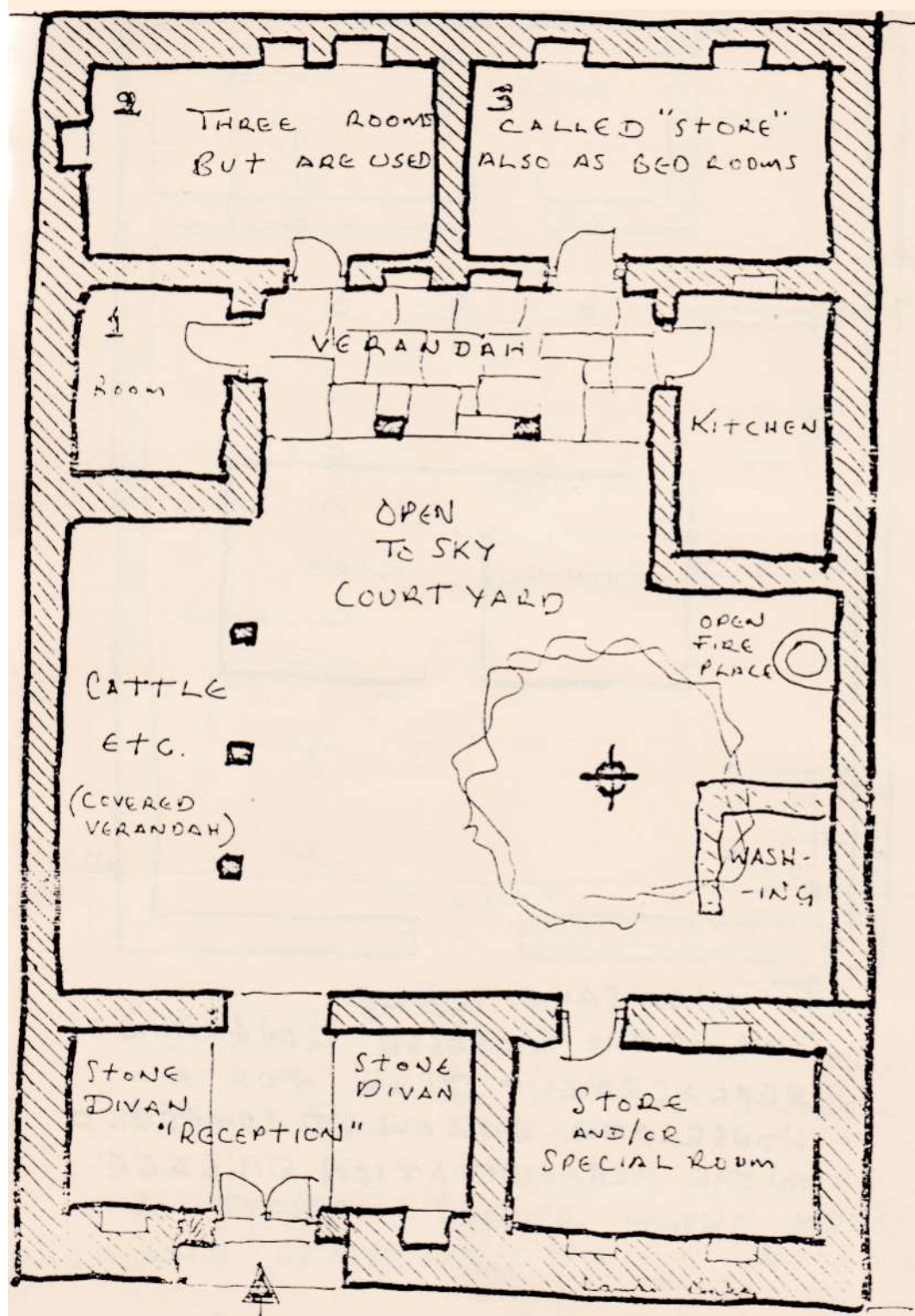
LOW DRY-STONE OR
ROUGH STONE IN MUD
BOUNDARY WALL.
MAINLY THATCH OR DRY STALKS & THATCH
ON RUGH WOOD POLES ETC.

**A TYPICAL 'LOWER' GROUP HOUSE
AND COMPOUND** (BUT OFTEN NOT A
REGULAR RECTANGLE) — FITTING IN
BETWEEN OTHER BUILDINGS, ROCKS, TREES
ETC. USUALLY BUILT ON THE OUTER SIDE
OF THE MORE WELL-OFF VILLAGERS.

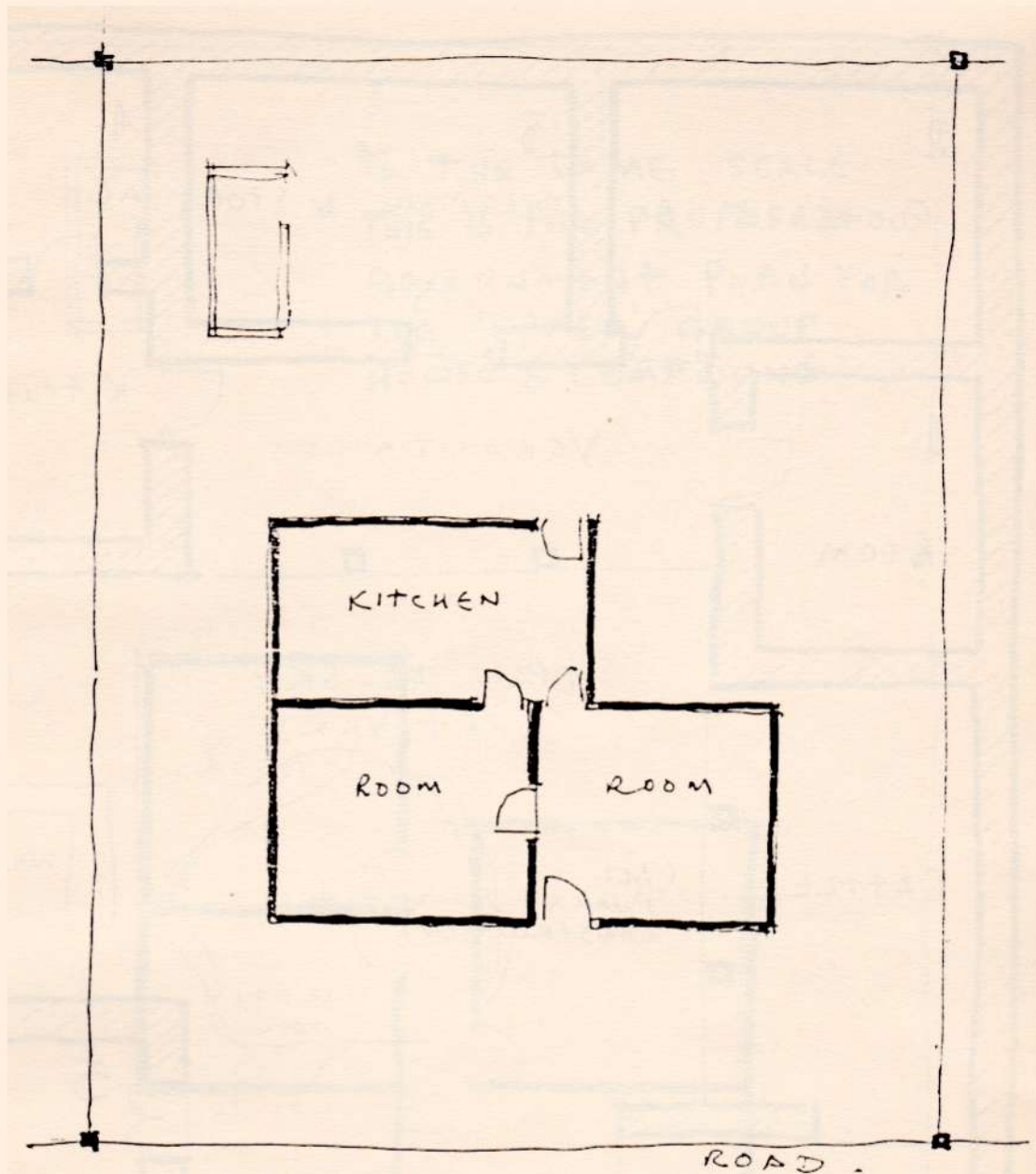


TO THE SAME SCALE
THIS IS THE PROPOSED GOVERNMENT
REPLACEMENT PLAN FOR A
HOUSE AND UNWALLED COMPOUND
IN THE REHABILITATION VILLAGE.

(the 'lower' group of houses)

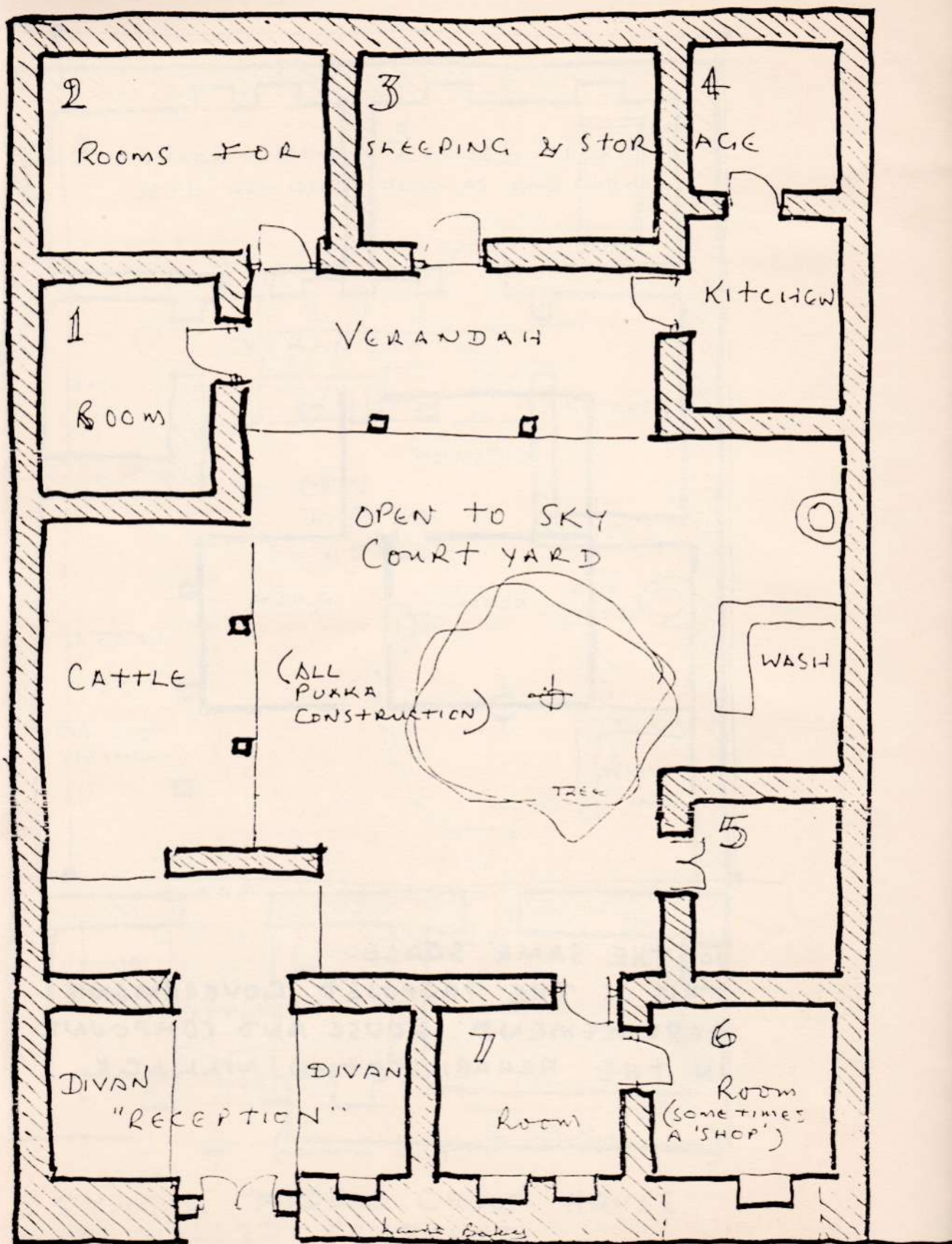


A TYPICAL 'MIDDLE GROUP HOUSE
AND WALLED COMPOUND.

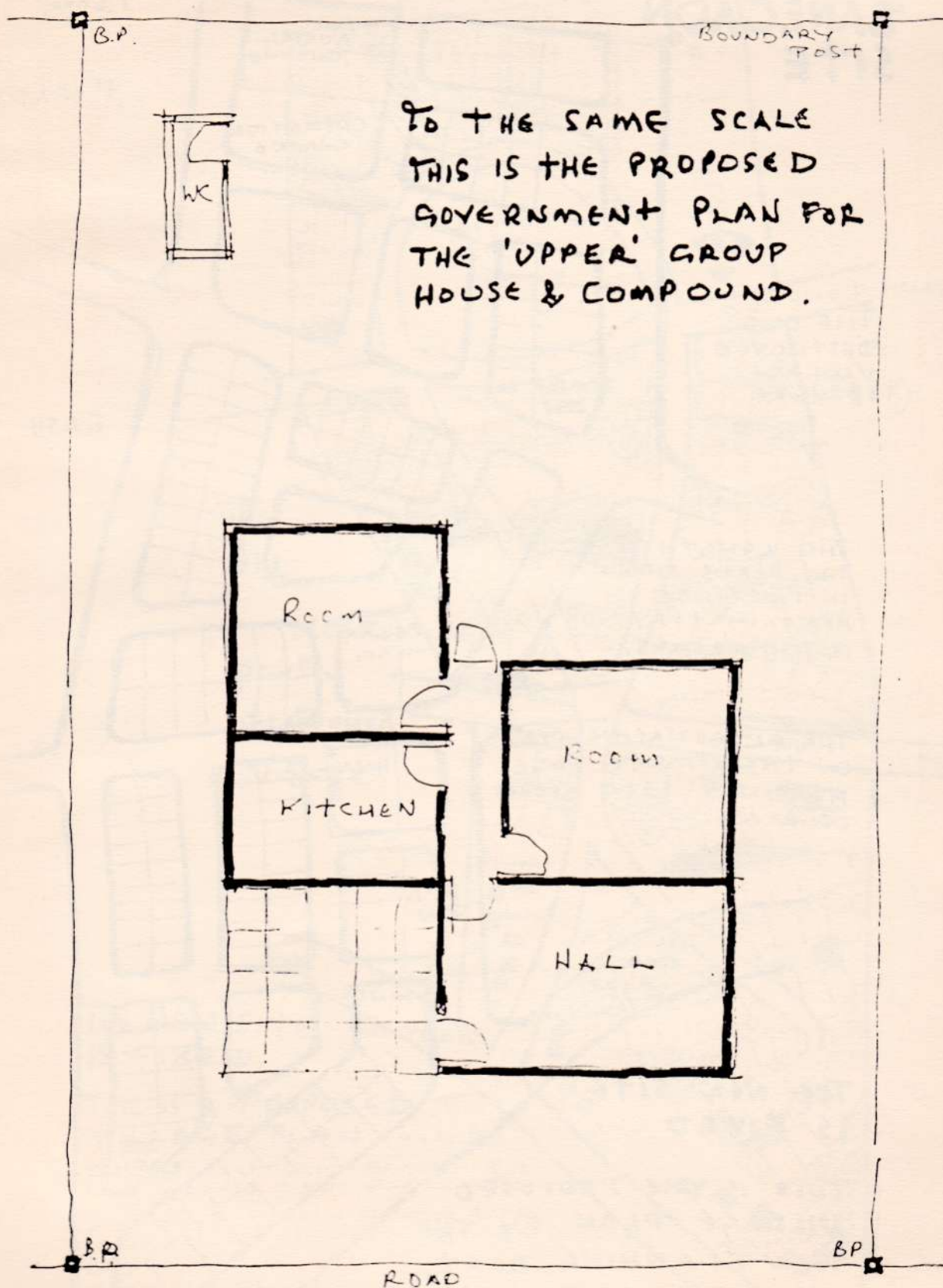


TO THE SAME SCALE
THIS IS THE PROPOSED GOVERNMENT
REPLACEMENT HOUSE AND COMPOUND
IN THE REHABILITATION VILLAGE

(the middle group of houses)



TYPICAL 'UPPER' GROUP HOUSE & COMPOUND



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NEW BANEGAON SITE

NORTH

SCALE
1:4000.

FIELDS

THE OLD
DESTROYED
VILLAGE
IS HERE



THE LENGTH OF
THE ROADS SHOWN
IN THIS PLAN IS
APPROXIMATELY
2700 METRES.

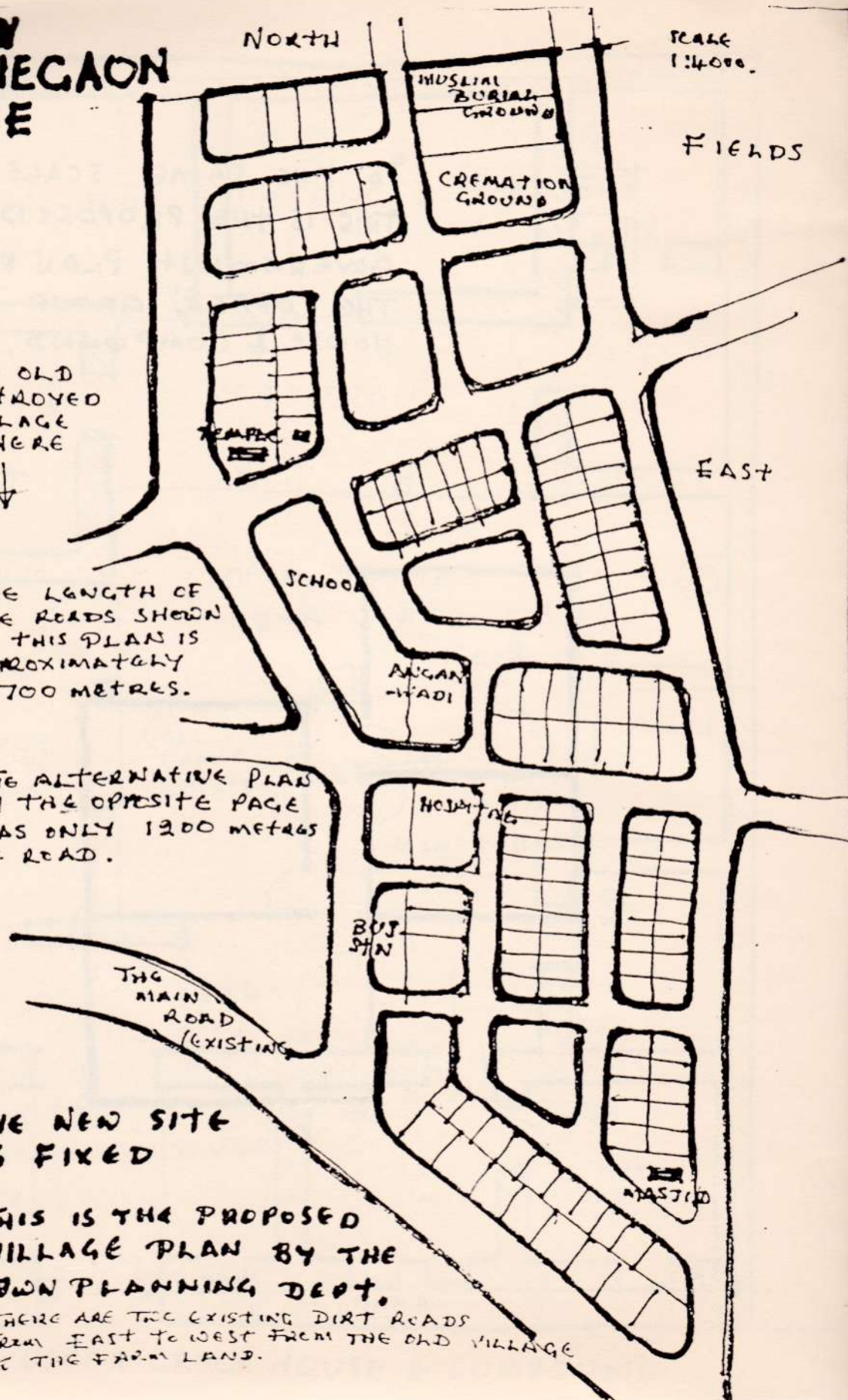
THE ALTERNATIVE PLAN
ON THE OPPOSITE PAGE
HAS ONLY 1200 METRES
OF ROAD.

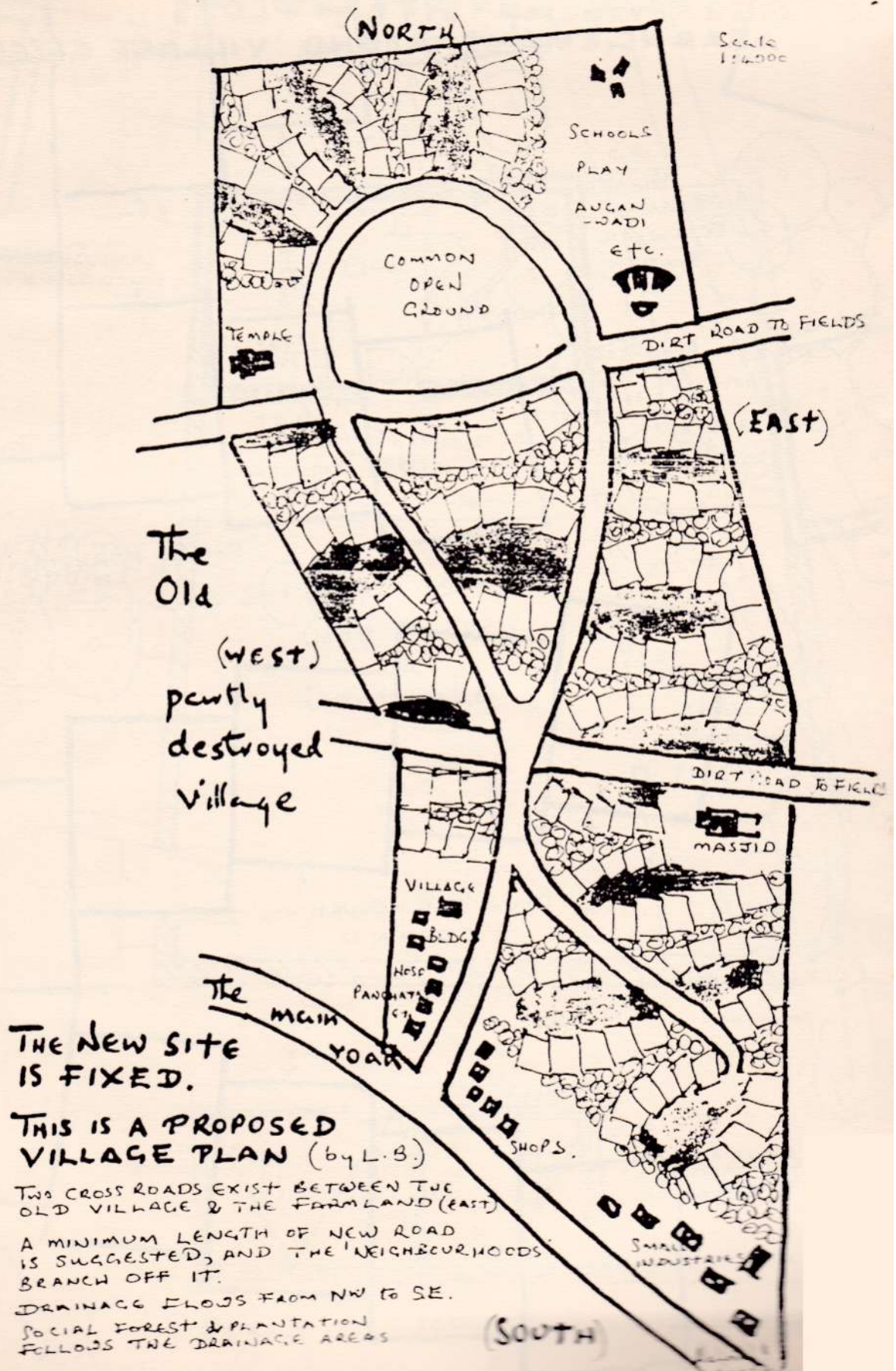
THE
MAIN
ROAD
(EXISTING)

THE NEW SITE
IS FIXED

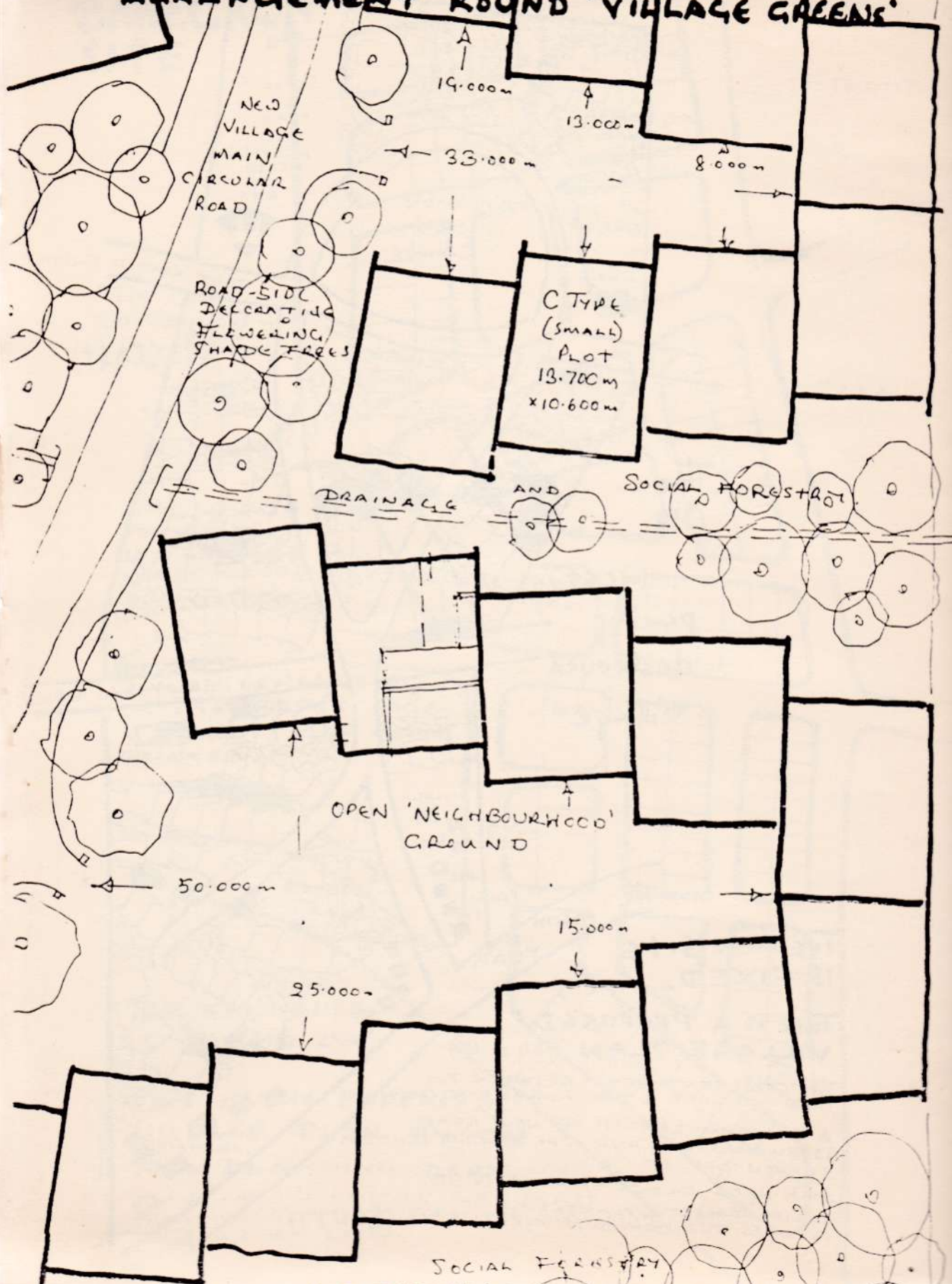
THIS IS THE PROPOSED
VILLAGE PLAN BY THE
TOWN PLANNING DEPT.

THERE ARE TWO EXISTING DIRT ROADS
FROM EAST TO WEST FROM THE OLD VILLAGE
TO THE FARM LAND.

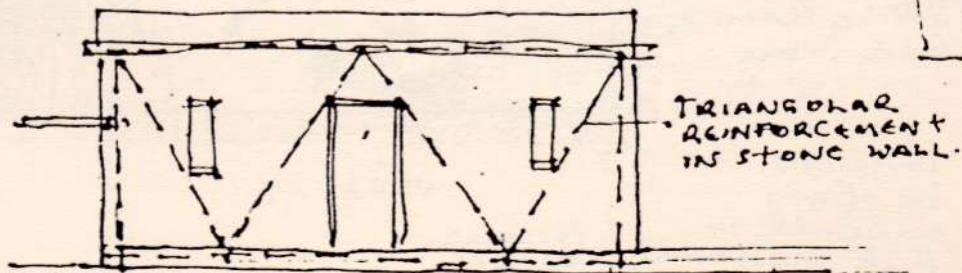
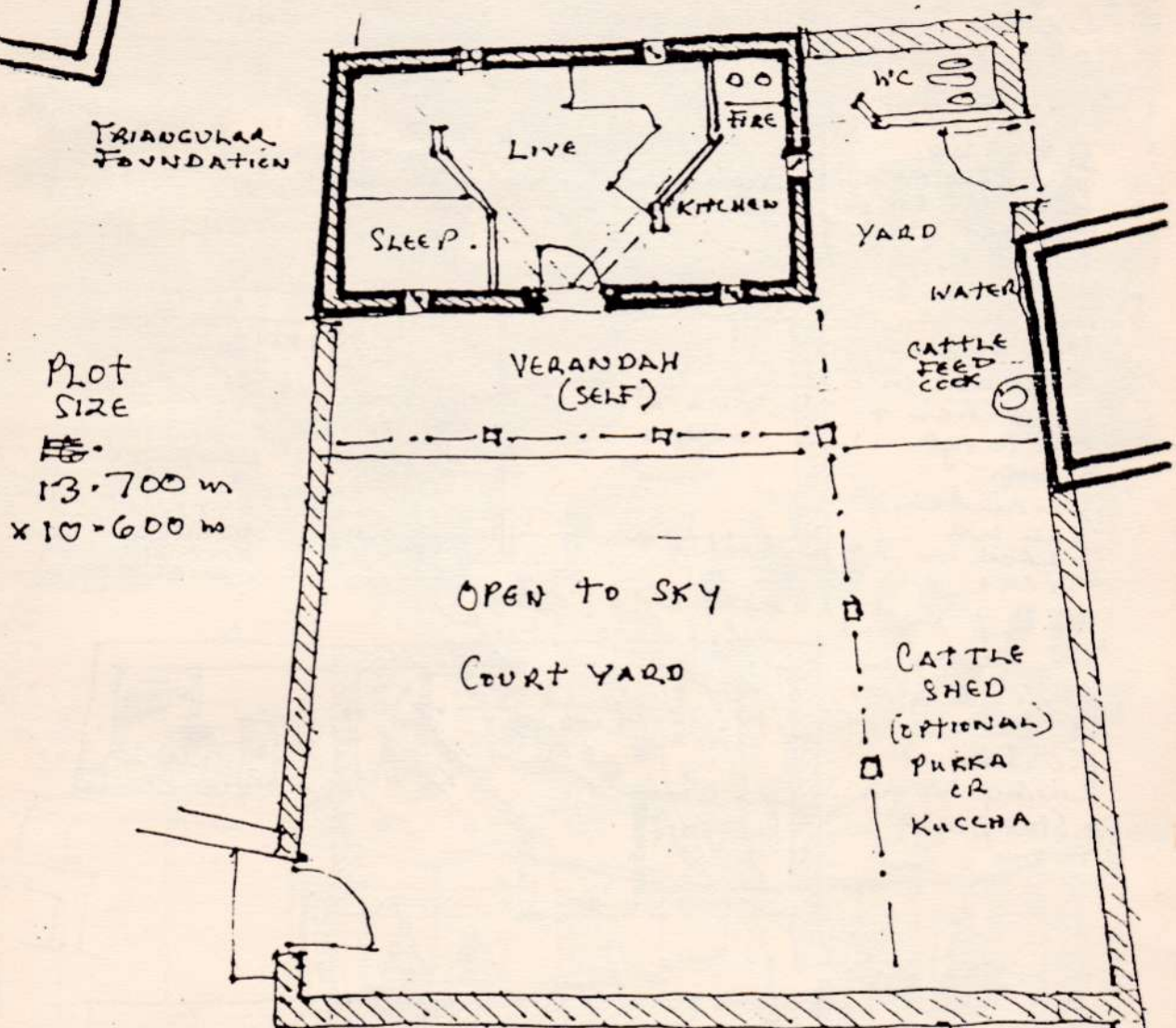




L.B.S. Proposed SITE - PLOTS ARRANGEMENT AROUND 'VILLAGE GREENS'



THE SMALL HOUSE AND PLOT.



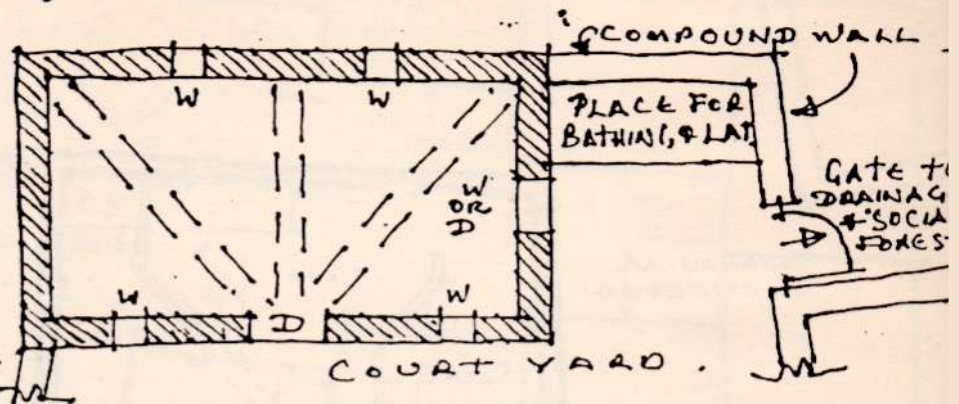
SCALE 1:100

Lavie Babu

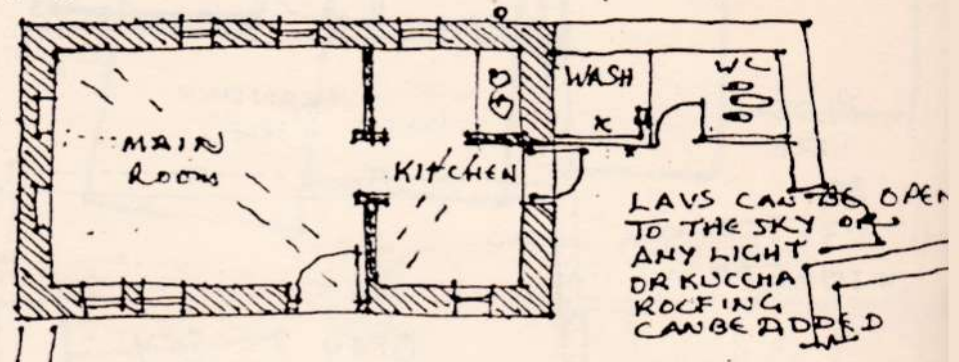
THE 250 sqft HOUSE PLAN.

This is the
Basic
250 sq ft.
PLAN.

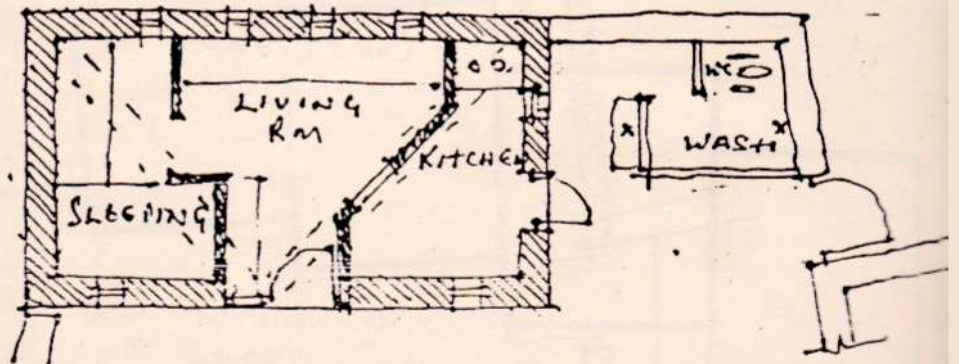
It can be
placed along
any side of
the court yard.



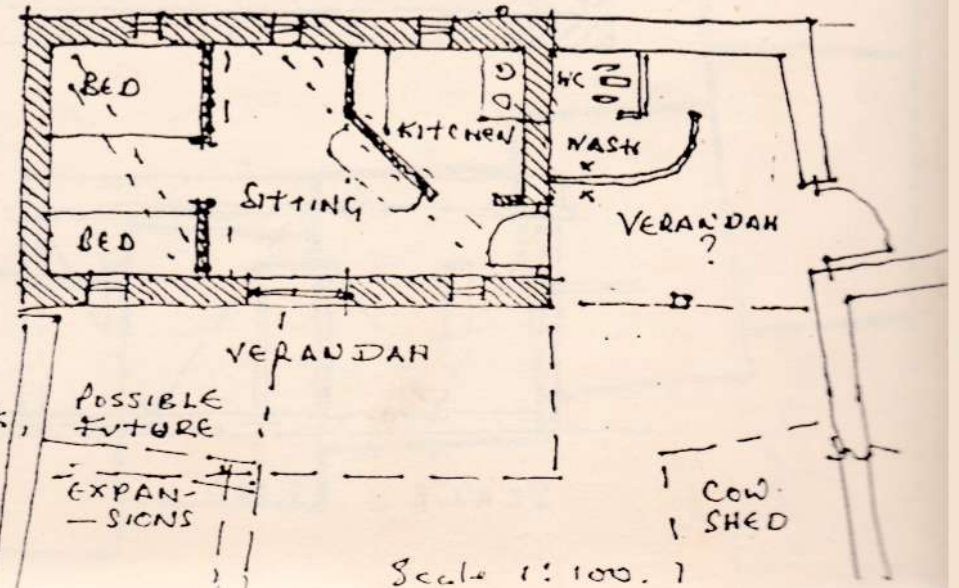
The same
basic plan
divided into
a Kitchen &
one large
room.
Verandahs
can be
added on 2
Sides



The same plan
divided into
3 Rooms—
Kitchen—
Living room
& Sleeping
room.



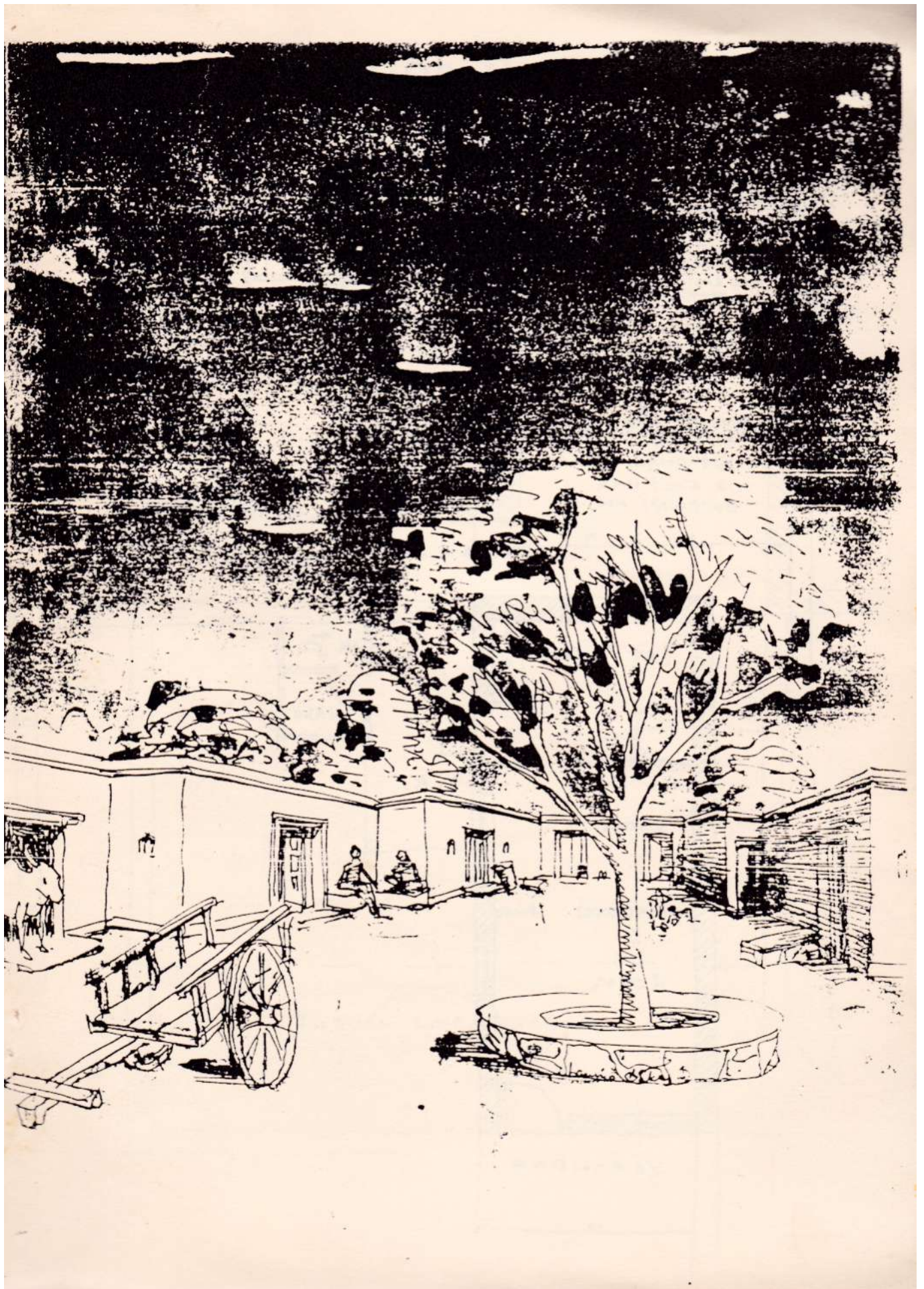
The same Plan
into 3 room.
Small Kitchen,
Sitting room &
Bed room.



Divisions can
be of any
material—
Brick, mud brick,
'Wattle & Daub',
Panelling etc.

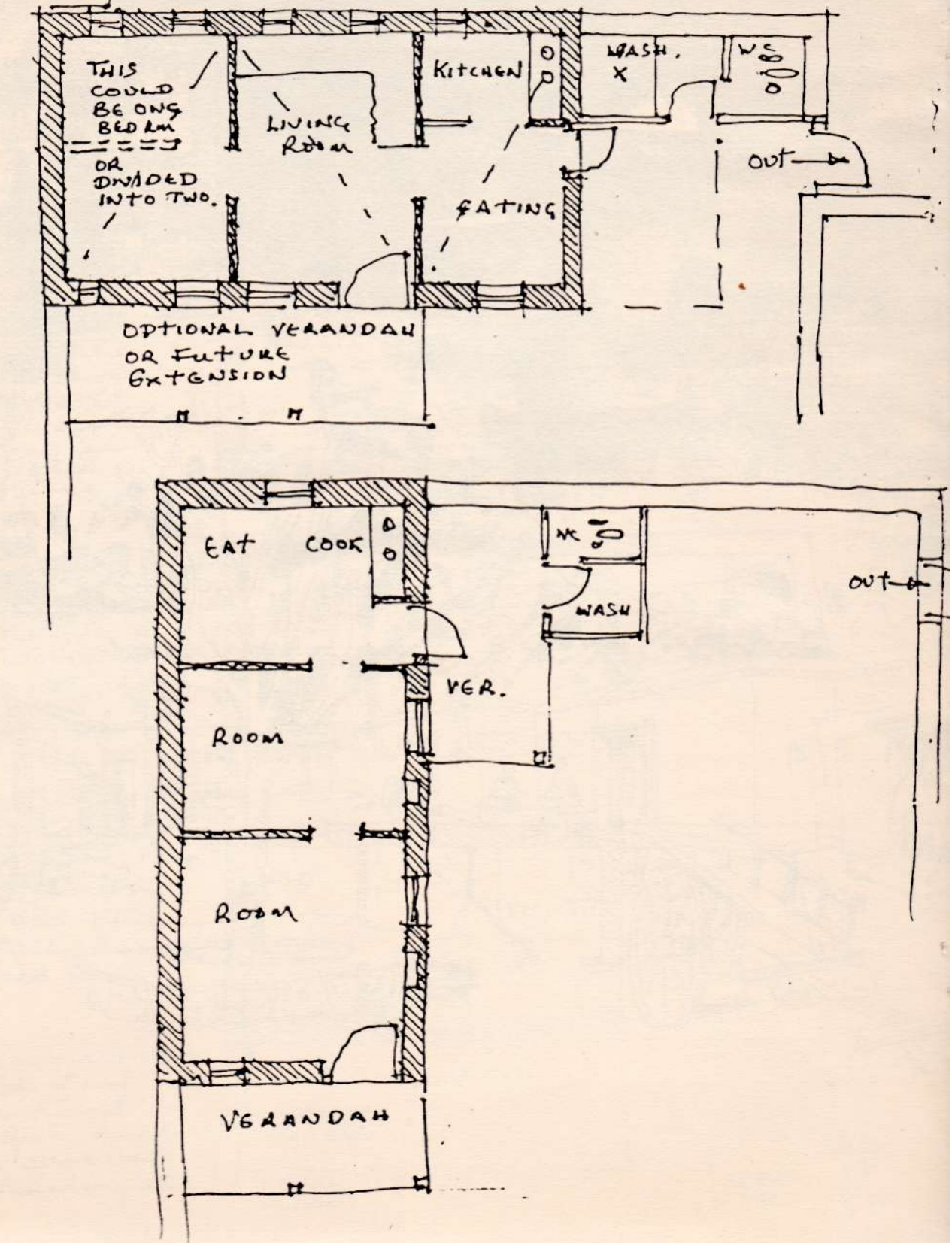
Leaves blank

Scale 1:100.



2 450 sqt HOUSE PLANS (MIDDLE SIZE HOUSE)

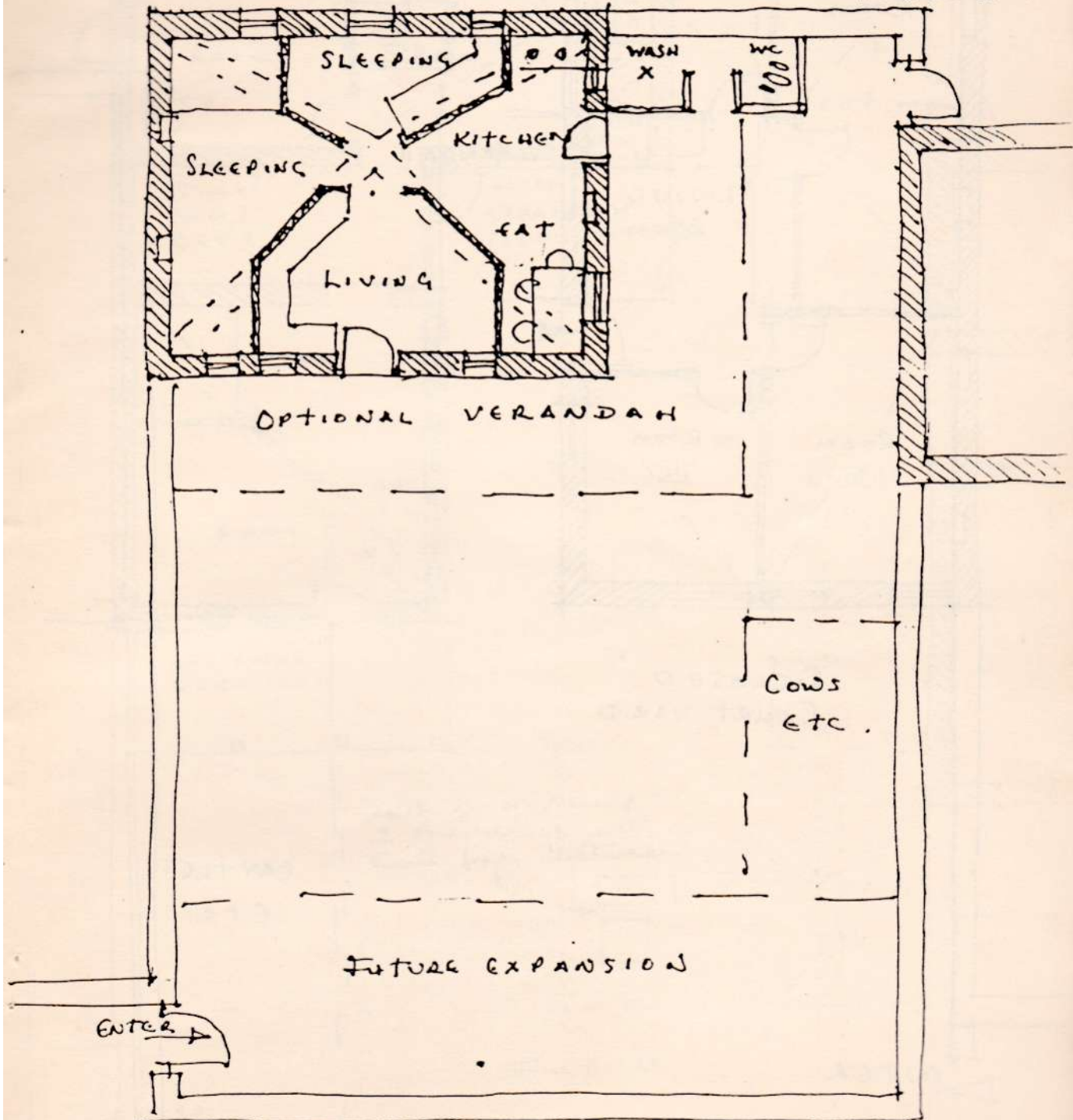
SCALE 1:100.



A 450 sqt HOUSE PLAN (THE MIDDLE SIZED PLAN)

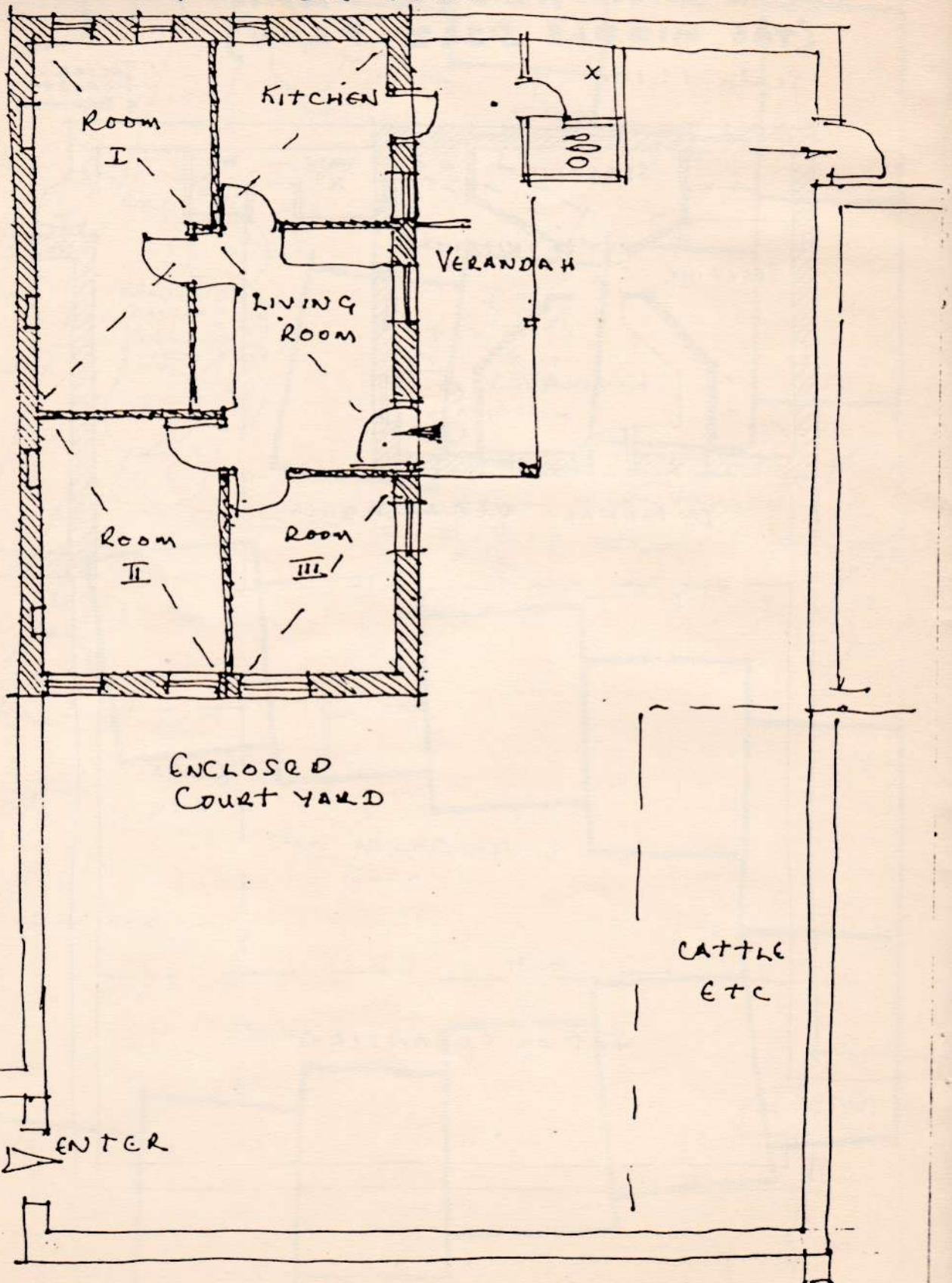
Scale 1:100

SOCIAL
FORESTRY
& DRAINAGE



A 750 sq ft HOUSE PLAN

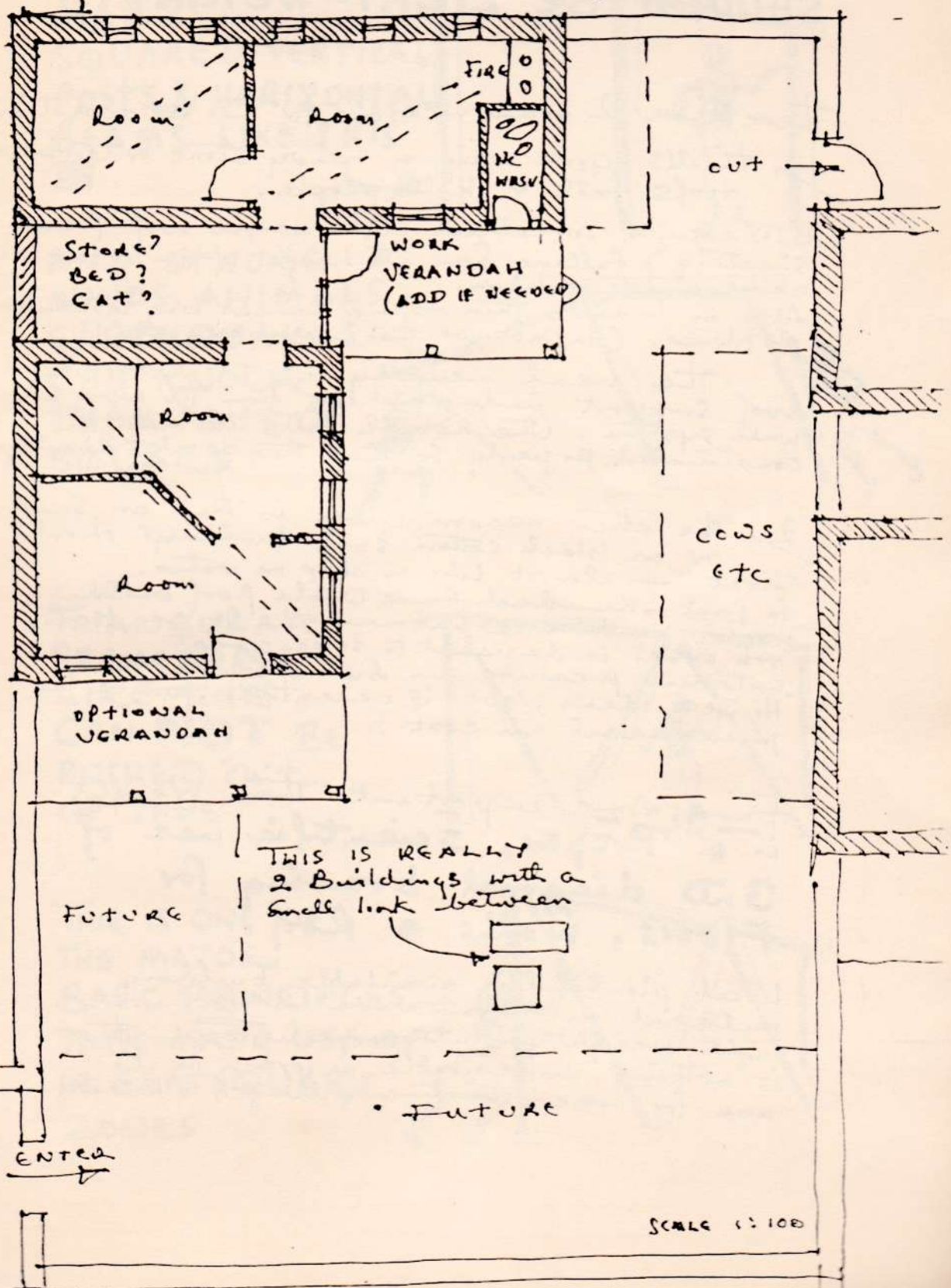
(THE 'BIG' PLAN)



A 750 ft HOUSE PLAN. (THE 'LARGE SIZE HOUSE')

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DRAINAGE &
SOCIAL FOREST



QUAKE ZONE BUILDINGS SHOULD BE LIGHT-WEIGHT?

There are 2 main reasons for this ~~an~~ assertion

1. Walls give way & heavy stone or timber roofs fall & kill people.

But even a so-called 'light weight roof' (e.g. sheeting) falling from a height of 8-10 feet can cause a lot of harm.

Also in India, thin roofing causes big insulation problems. (In hot weather - unbearable!)

The real remedy is to make the roof support independent from the normal wall system. (The normal walls too must be constructed properly so that they do NOT disintegrate!)

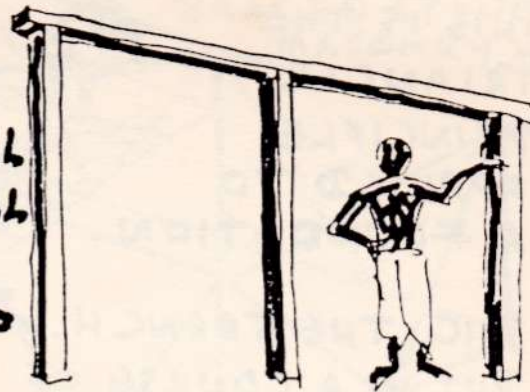
2. The other reason given is that on sand or on black cotton soil buildings should "float" - almost like a ship on water.

In fact - the ideal Earthquake proof building would be like a submarine! It can float, roll over, is designed to take great external pressure - but of course such 'Hi Tec' ideas, even if acceptable, would be phenomenal in cost!

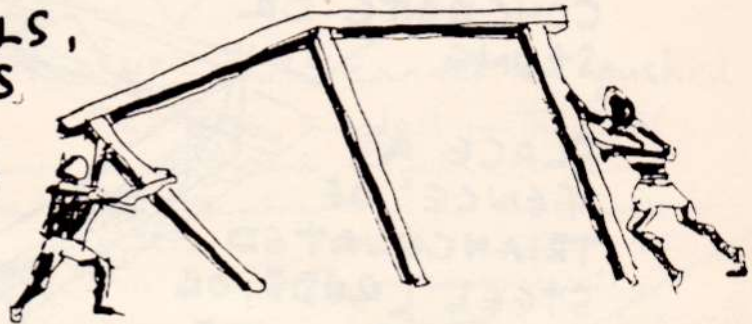
Far more important than Weight is a Proper, Scientific use of 3-D diagonal bracing for Floors, Walls & Roof.

Local plentifully available building material in Marathwada is not light-weight, but properly used there is nothing undesirable or wrong in its use for reconstructing villages & houses.

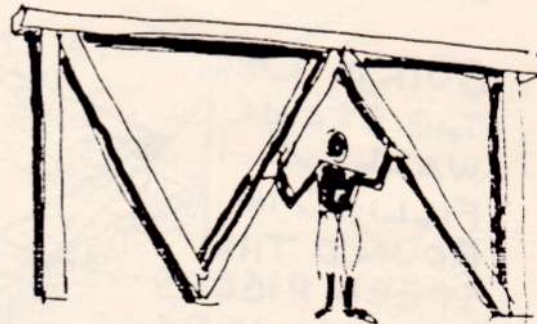
MAKE
SQUARED VERTICAL
POSTS & HORIZONTAL
BEAMS LIKE THIS



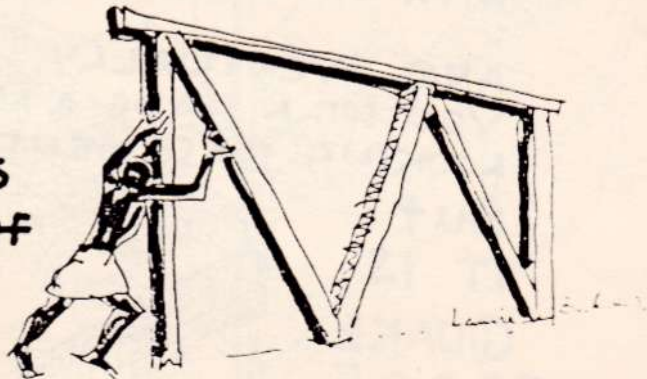
AND STRONG
WINDS, ANIMALS,
EARTHQUAKES
CAN KNOCK
THEM "OUT OF
SQUARE"



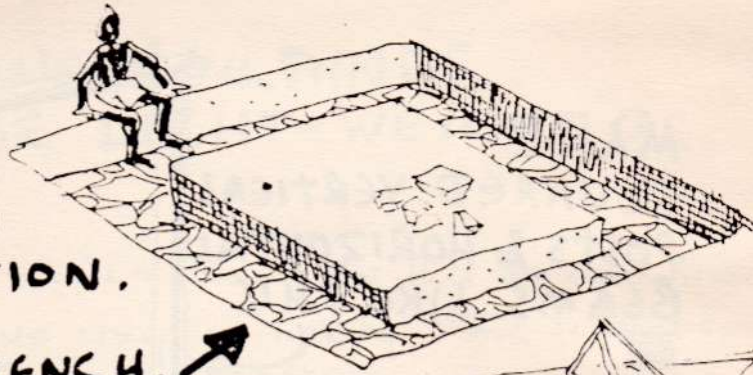
TRIANGULAR
STRUCTURES
LIKE THIS
CAN **NOT** BE
PUSHED "OUT
OF TRUE"




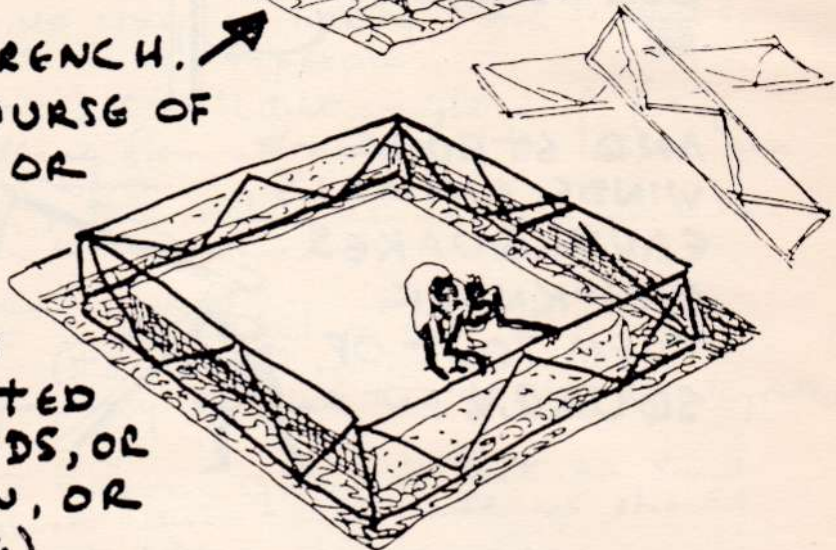
THIS IS ONE OF
THE MAJOR
BASIC PRINCIPLES
TO BE MADE USE OF
IN EARTHQUAKE
ZONES



THIS IS THE
'TRIANGLE'
PRINCIPLE
APPLIED TO
A FOUNDATION.

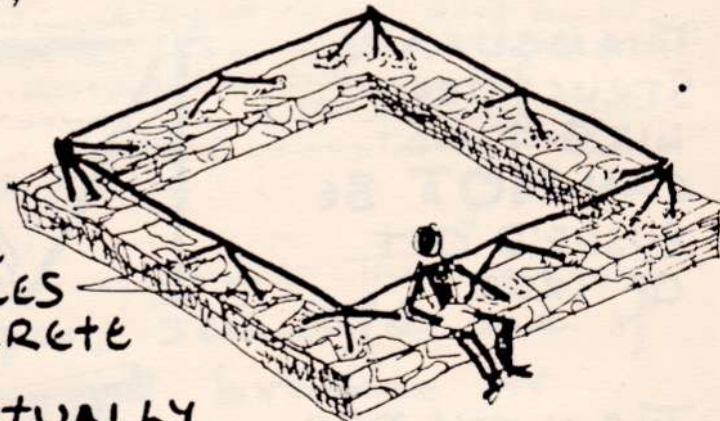


DIG THE TRENCH. 
PUT IN A COURSE OF
CONCRETE OR
STONE



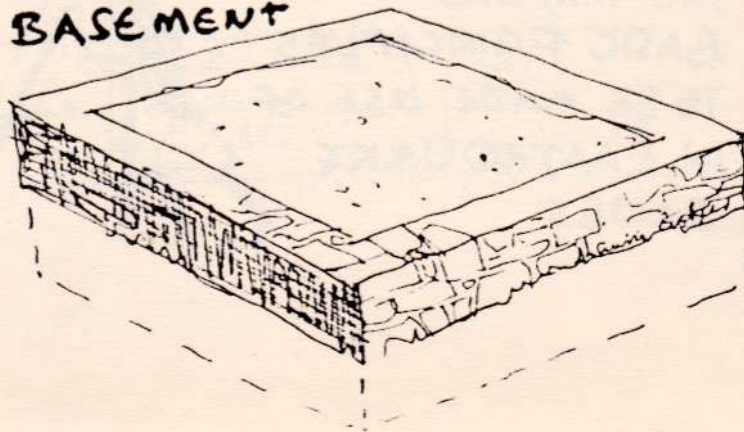
PLACE A
'FENCE' OF
TRIANGULATED
STEEL (RODS, OR
ANGLE IRON, OR
G.I. PIPING)

BUILD UP
THE STONE
WALL,
FILLING IN
ROUND THE
STEEL PIECES
WITH CONCRETE



AND EVENTUALLY
YOU WILL HAVE A NORMAL
LOOKING BASEMENT

BUT
IT IS
QUAKE
PROOF



REINFORCED BRACED STONE MASONRY WALLS.

A CAGE
OF TRIANGLES

makes a structure that cannot be pushed
over.

One of the simplest methods of making a braced, reinforced stone masonry structure is to construct or assemble the reinforcement - & then build the masonry wall all round it, pouring in concrete around the reinforcement as the wall increases in height.

The frame is then an integral part of the wall & the common R.C.C. Bands are not necessary.

concrete

It of course has to be understood that the masonry must be properly bonded and a reasonably strong mortar is used.

'Bracing' Reinforcement
Can be of Tor Steel Rods,
Angle Iron,
C.I. Pipes
or Split Mature Bamboo
etc.

Handwritten signature/initials

SAND

is one of the main ingredients of reinforced concrete. It **MUST** be clean & free from humus & impurities.

The few small streams in the earth quake area have very little & v. impure sand.

P.W.D. work (such as water tanks etc) brings sand from the Godavari river & other places about 400 Km away.

Damaged buildings clearly show that dirty local sand was mainly used. The concrete is all broken & crumbles in the hand.

It must be kept in mind that besides about 20,000 houses there will be public buildings, roads, irrigation and drainage & sanitary work, culverts which, altogether, will call for an enormous quantity of sand to be imported.

All designs calling for various forms of concrete & reinforced concrete must be examined & R.C. must be used sparingly.

CEMENT

will, of course, have to be used in the reconstruction work — but it will all have to be brought in from other regions.

It should be kept in mind that up till about 30 years ago Lime (chunam) was manufactured & extensively used for mortars & plaster work in the current earthquake area & there is no good reason why it should not be re-introduced to avoid unnecessary import of cement.

It should also be kept in mind that the ultimate strength of lime mortar & plaster is just the same as that of cement.

It's setting time is slower, but a very small amount of cement in the lime-sand mixture, or the lime-sand-sukhi mixture remedies this mild hindrance.

Just remember, also, that all our old big dams were built with lime — not cement.

BUILDING MATERIALS. (LOCAL)

STONE (& LATERITE)

All the destroyed villages are now huge piles of stones. Some are large & 'squared' others of varying sizes & shapes. The sizable ones are plentiful & can be reused. The small ones can be used for 'metal' for concrete.

At present people are averse to the reuse of stone, for obvious reasons. But it would be foolish not to use them, at least for foundations & basements, which cannot 'fall on them & kill them'.

Elsewhere it is described how stonemasonry walls can be reinforced & can be used in 'Earthquake Zones'.

Even in 'field' & 'outside village' houses, people build their own low stone walls. Usually these fall down easily because they have little knowledge of 'bonding' (It can very easily be taught to anyone).

BAMBOO

A mature 'building' bamboo can be split lengthwise & used for reinforcement (its tensile strength is similar to that of TOR steel!).

India's North East States continue to build extensively with bamboo because they are earthquake zones & bamboo remains when reinforced concrete falls.

There is extensive research & experience of the use of bamboo reinforcement in reinforced concrete. (see I. E. A. I.)

BAMBOO REINFORCEMENT.

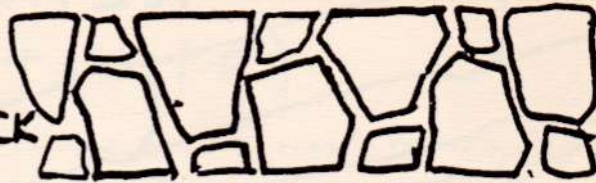
Only mature 'building' bamboo must be used (Grandparents can tell you which is a "building" bamboo and which is not.)

A 4" or 5" diameter (base end) is split into 6 strips. Two strips are wired back to back (unlike steel) in concrete.

Bamboo can safely be used (unlike steel) in Lime concrete which is almost an energy-free material & is suitable for stone masonry.

45 cm
18 inches
STONE WALL
(or STONE PIÉ WALL)

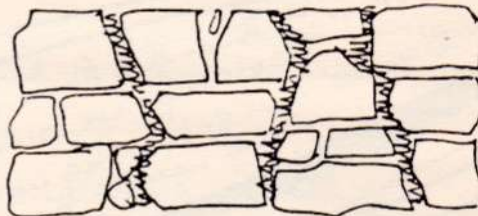
STONES
MUST INTERLOCK



LIKE THIS ✓



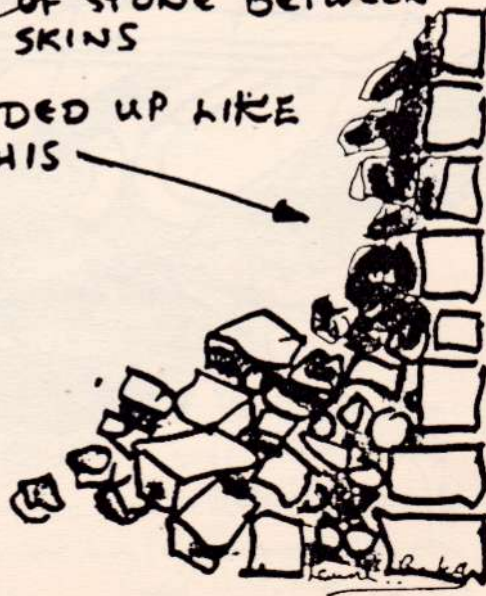
NOT LIKE THIS ✗
WHERE VERTICAL
CRACKS CAN
EASILY DEVELOPE.



THROUGHOUT THE AREA
WALLS THAT WERE BADLY
BUILT LIKE THIS WITH
NOTHING BUT A LOT OF
BITS OF STONE BETWEEN
2 SKINS



ENDED UP LIKE
THIS



Many of the survivors now
HATE STONE.

Stones killed parents and
friends: Stone killed their
children.

They naturally revolted at
the thought of reusing
good building stone to
rebuild their new homes.

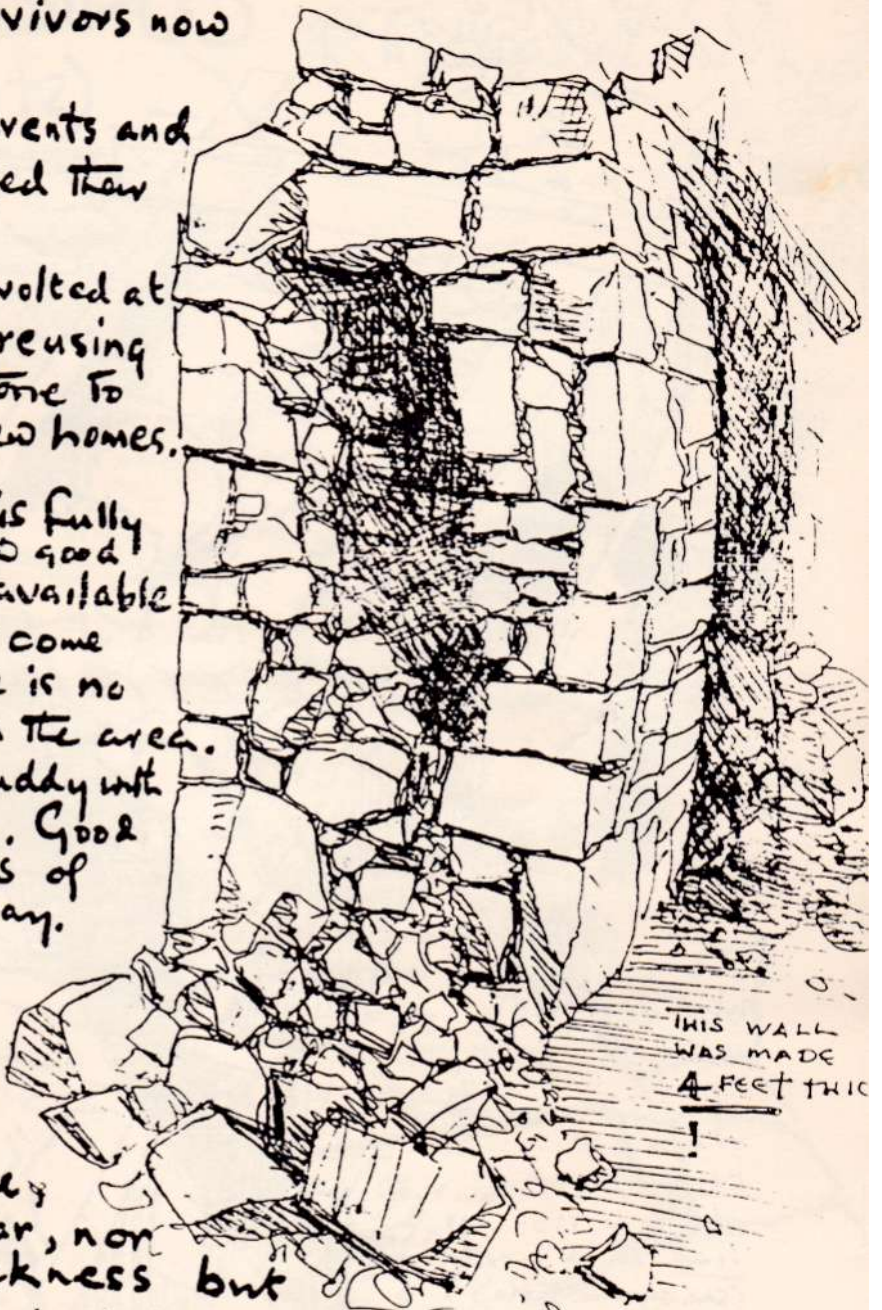
This revulsion is fully
understood. But good
bricks are not available.
Steel & cement come
from afar. There is no
proper sand in the area.

River sand is muddy with
black cotton soil. Good
sand is hundreds of
kilometers away.

People MUST be
shown that
collapse of stone
walls was not
because of the
quality of stone,
nor poor mortar, nor
adequate thickness but

**ENTIRELY DUE TO TOTAL ABSENCE OF THE ART
AND PRINCIPLES OF BONDING.**

This is an accurate sketch (a photo is available) of the
remains of ~~an~~ **UPPER CLASS FACADE** with fancy
'skins' on both sides & the middle small useless rubble



THIS WALL
WAS MADE
4 FEET THIC
!

**STONE KILLED — BUT ONLY
BECAUSE IT WAS IMPROPERLY USED,**

WASTE STONE CONCRETE WALL (STONE PISÉ)!

There will be thousands of small stone pieces when the debris is cleared away. Useless for a proper stone wall.

2 Planks can be made into a removable frame - the width of an ordinary stone wall. (40-50 cm) (15-20")

Pieces of stone with one flat side are arranged against the inside of the plank frame - with mortar. Other lumps are placed here & there between - & the remaining space filled with a very rough concrete of smaller stones.

Mortar

can be

of a 1:8
or even 1:10

Cement/sand

or 1:4 or 1:5

lime sand mortar
(see separate table)

or even a

Soil/Cement, or

Soil/Lime/Cement mix.

The rough concrete aggregate is of any stone bits from the size of a pea to bumps the size of an orange.

This will be OK
for the desired compound walls.

CROSS TIE BLOCKS FOR STONE WALLS

Very often stone is locally, plentifully, available but only in comparatively small or ill-shaped sizes. Good bonding, therefore, is difficult or even impossible.

Similarly, even when good squared stones can be made, they vary so little in shape & size that, again, good bonding is not possible & vertical cracks easily develop.

As a remedy to this, & in order to make use of large quantities of small stones, concrete blocks of a special size & shape can be used for ensuring cross bonding.

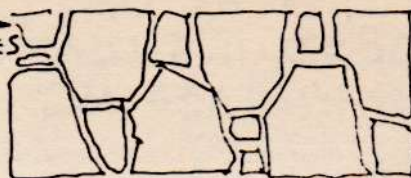
The concrete mix remains normal but stone (aggregate) sizes can range as a mixture between small pieces the size of a pea to larger lumps the size of an apple.

As no reinforcement is involved (or only bamboo reinforcement) locally made lime (chunam) may be used instead of cement. (The energy or fuel required to make cement is 100X that used for making lime, so is to be encouraged where ever & whenever possible).

These Cross Tie Blocks will be made the same length as the thickness of the wall (usually between 40 & 50 centimeters (16"-20")). The tie block can be of any width - best between 8 inches & 12" (20-30 cm), & the thickness about 4 inches (10 cm). Better not bigger, as handling by the mason is difficult.

Similarly CORNER STONES are often not available so a similar block can be made to ensure strong good bonding at the corners or ends of stone walls.

IDEAL BONDING BUT NOT POSSIBLE WITH SMALL STONES

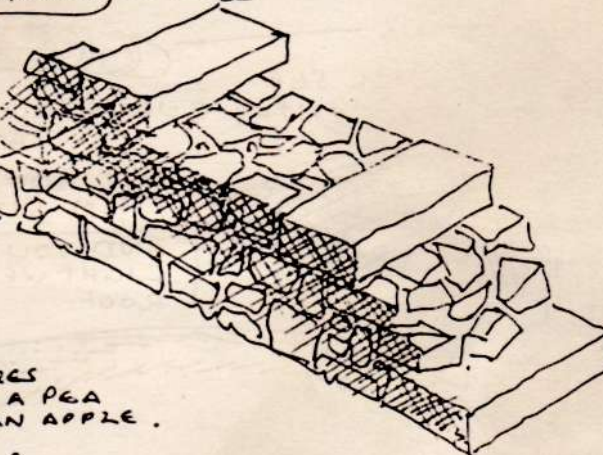


SMALL IRREGULAR STONES WILL ONLY PRODUCE "BONDING" LIKE THIS WHICH, OF COURSE, IS USELESS.

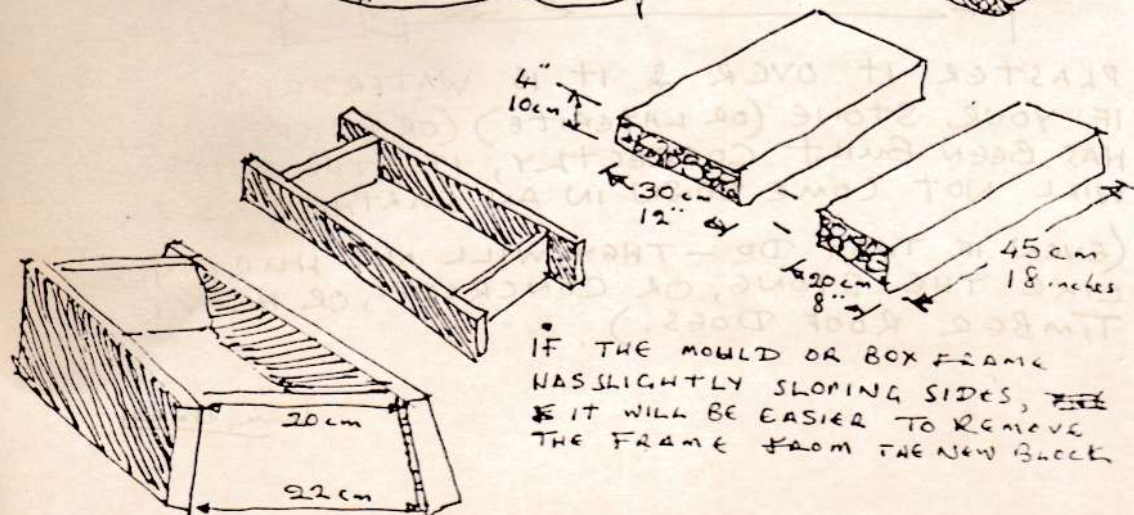
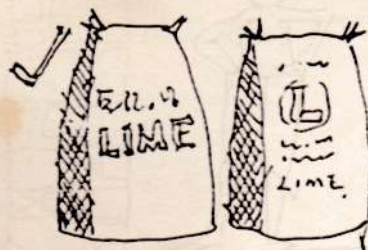


SQUARED STONES OF SMALL SIZE ARE EQUALLY USELESS

CROSS TIE BLOCKS WILL PREVENT THE SMALL STONES FROM FALLING APART



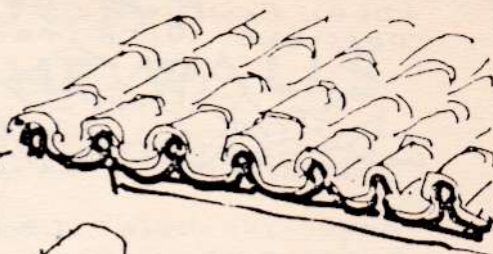
ALL SIZES FROM A PEA TO AN APPLE.



IF THE MOULD OR BOX FRAME HAS SLIGHTLY SLOPING SIDES, IT WILL BE EASIER TO REMOVE THE FRAME FROM THE NEW BLOCK

LIGHT WEIGHT, GOOD INSULATION, 'POT' ROOFING

THE POTTER WHO MAKES
INDIA COUNTRY PANTILE
CAN MAKE YOU
SLIGHTLY CONICAL,
OPEN AT TOP & BOTTOM
TILE 'POTS' LIKE THIS



YOU CAN NEST THEM TOGETHER
UNTIL YOU HAVE A LONG ROW
OF THEM, UP TO TEN FEET LONG (OR MORE)

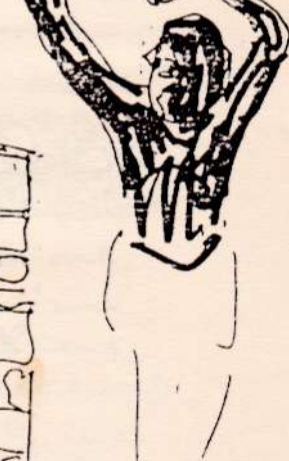
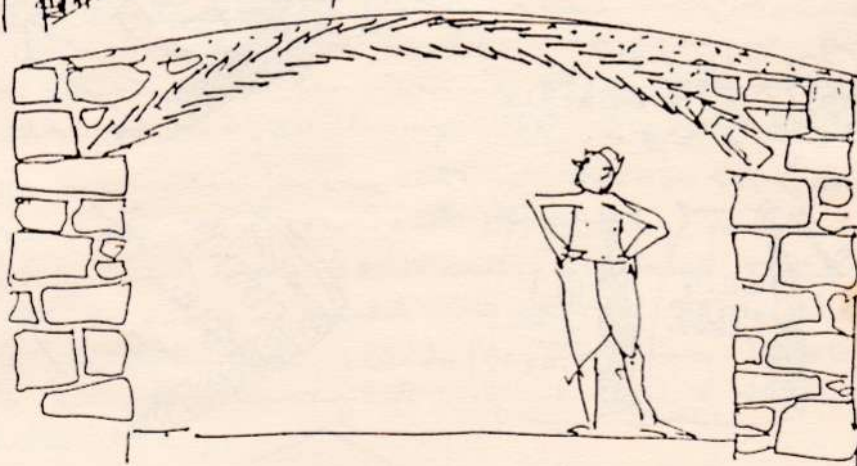
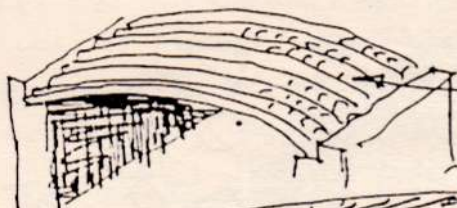


LIKE THIS

AND YOU WILL SEE

THAT THEY GENTLY CURVE LIKE AN ARCH

PUT ROWS OF
THEM SIDE BY SIDE
AND YOU HAVE A
LIGHTWEIGHT
ROOF



PLASTER IT OVER & IT IS WATERPROOF.
IF YOUR STONE (OR LATERITE) (OR BRICK) WALL
HAS BEEN BUILT CORRECTLY, IT, THE POTS,
WILL NOT COME DOWN IN AN EARTHQUAKE.

(EVEN IF THEY DO - THEY WILL NOT HURT YOU
LIKE THE STONE, OR CONCRETE, OR HEAVY
TIMBER ROOF DOES.)

Lamin Baker

C.I. SHEETS

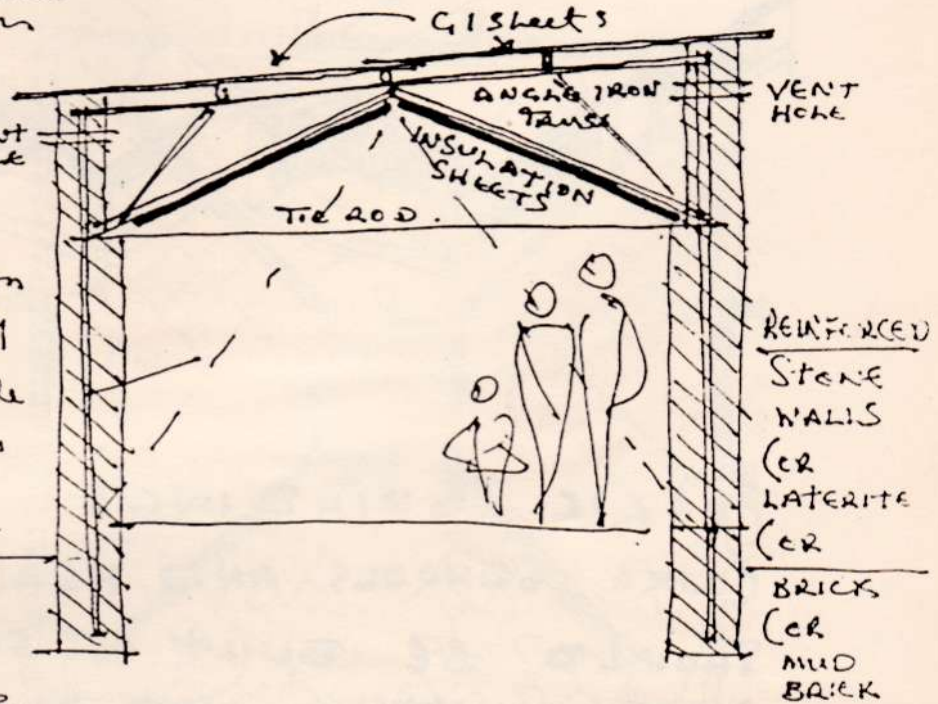
have been used extensively for relief work & will eventually be 'unused'

These can be used for almost flat roofing (desired by occupants)

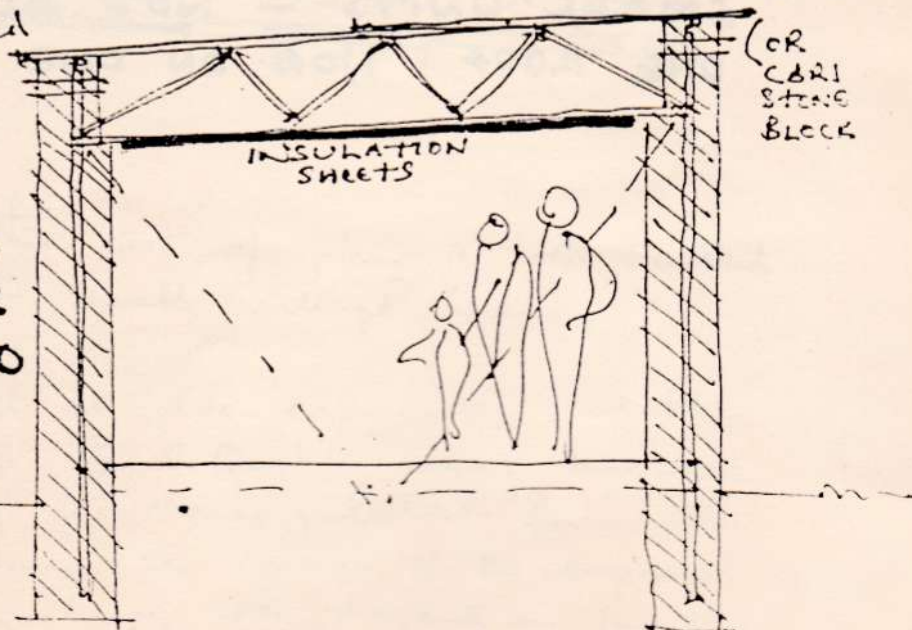
Heat/Cold insulation

can be given by any simple insulation sheeting on the underside of trusses

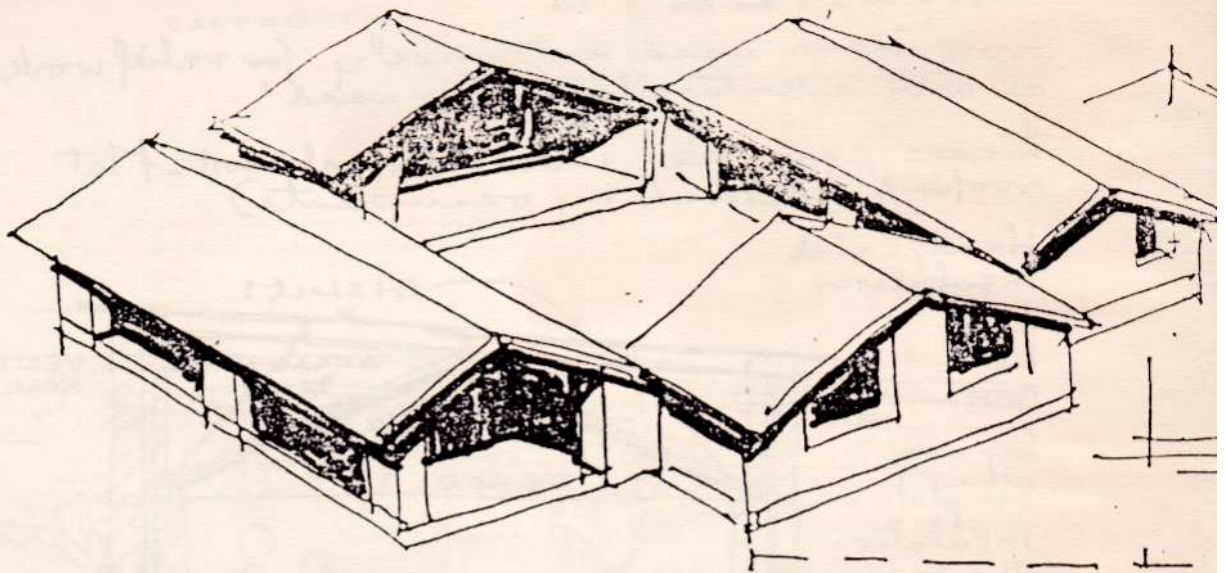
The space between roof & ceiling must be ventilated



OTHER SHEETING MATERIAL CAN ALSO BE USED IN THIS WAY



IT MUST BE UNDERSTOOD THAT THE ROOF FRAMEWORK IS FIXED TO THE WALL REINFORCEMENT.



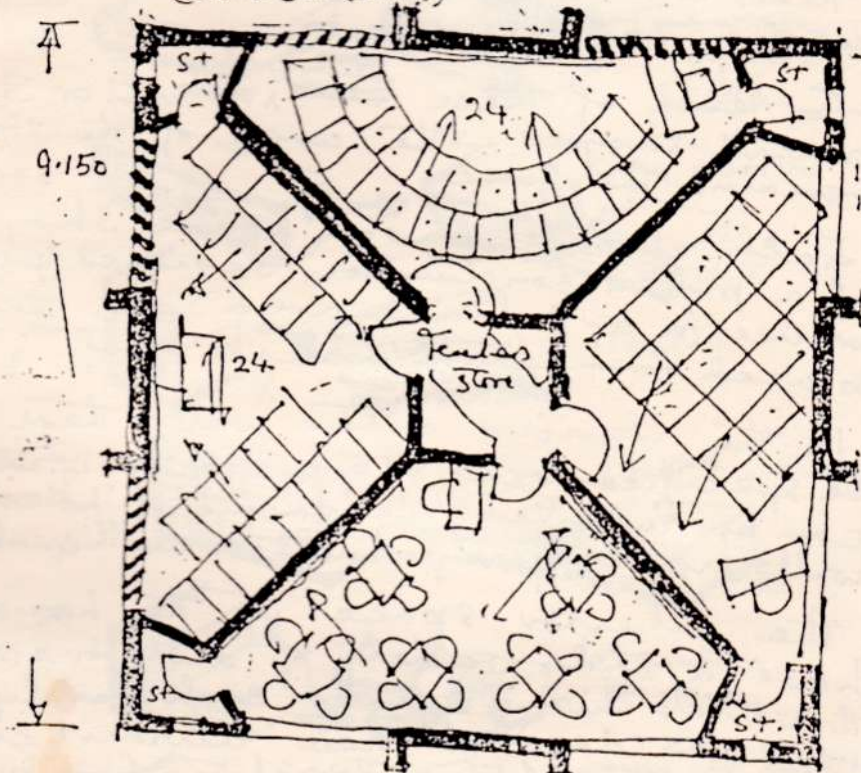
PUBLIC BUILDINGS
(LIKE SCHOOLS AND HEALTH CENTRES
SHOULD BE BUILT OF SEVERAL
SMALL UNITS - NOT ALL UNDER
ONE ROOF, NOR ON ONE FOUNDATION.

Laurie Baker

A SCHOOL

Scale 1:100

SCHOOL FOR about 100.
(LAYS SEPARATE)



Louis B. Schuy

This sort of plan is well suited to small village needs.

It is also especially suitable for 'Earthquake' areas because of its triangulated foundation plan. The design of the super-structure will depend on locally available materials.

THE HOUSE PLANS.

There is no intention of regimenting every family into one identical plan.

- 1 There are 3 basic plot sizes. The areas in each type will be the same but the shapes may differ.
- 2 There are 3 basic House Plans, 250, 450 + 750 square feet.
- 3 For each of these ~~there are~~ ^{We propose} 2 or 3 basic overall shapes — the area of the shapes remains the same.
- 4 Each of these basic house shapes is of a pukka construction designed specifically for use in a service area — (in these cases braced foundations walls & roofing are proposed)
- 5 In the various outer walls there will be specified areas where doors & windows can be inserted (the placing of 'holes' in walls is very important re earthquake areas.)
- 6 The interior space in the house can have a wide variety of divisions into the various living spaces each family may need or desire. These dividers can be of any lightweight material — from brick, to mud brick, wattle & daub, wood or ply or plaster screens or panels and so on.
- 7 A walled but roofless washing & latrine area ~~are~~ to be provided. The occupants may add their own roofing as desired.
8. Each compound is surrounded by a pukka braced stone wall. As per local tradition, the entrance is on one side (from the proposed "neighbourhood area") for the use of people. At the rear a gate is provided into the common drainage area & social forest. This gate is for the coming & going of cattle, fire wood, fodder, etc.

BUILDING SHAPES

53

Good but Not practical



GOOD



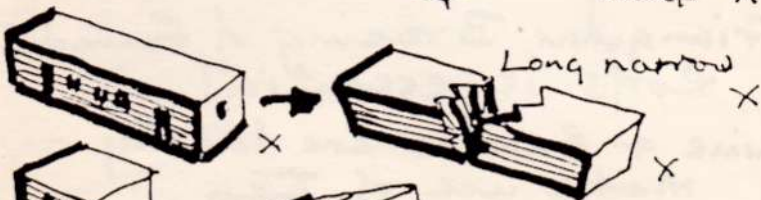
small
squat ✓

Not so
Good



Large
Square
blcls X

Not so
Good



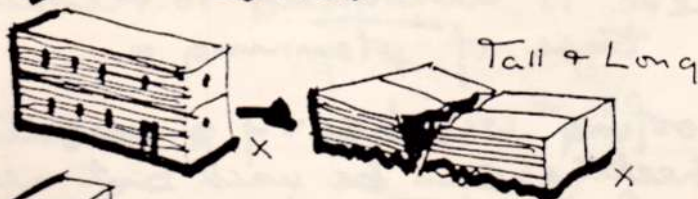
Long narrow X

Not so
Good



Too tall X

Not so
Good.



Tall & Long X

Not so
Good.



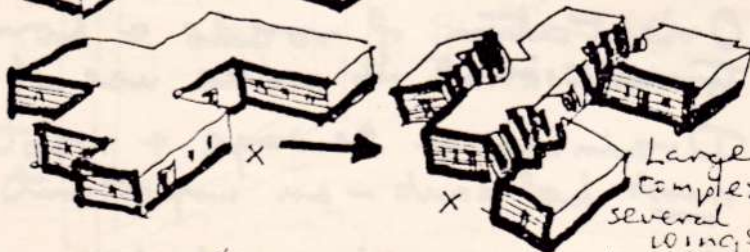
Irregular
1 1/2 storey X

Good



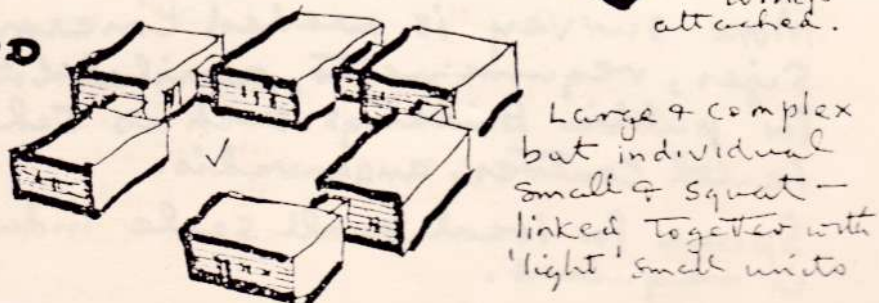
LOW SQUAT SQUARE
GROUND FLOOR
✓ MANSARD OR SLOPING
UPPER STOREY

Not so
Good



Large
Complex
several
WINGS
attached X

Good



Large & complex
but individual
small & squat -
linked together with
'light' small units

S U M M A R Y

The local available materials are satisfactory. It is the bad, unbonded stone masonry that is mainly at fault.

Good sand is not locally available so avoid as much R. Concrete & Ferro Cement as possible.

Triangular Bracing of Foundations, Walls, Roofs is essential.

Line & Bamboo are locally available. Make use of them.

People like, & require, the courtyard plan. There is everything to recommend this type of planning.

Roofing was heavy & unsatisfactory. Sheet piling can be used but needs ceilings for insulation. Local potters can make burnt clay cones for roofing - v. good insulation.

Interior Road plan in villages must be as short as possible & economical. 'Neighbourhood' planning is desirable.

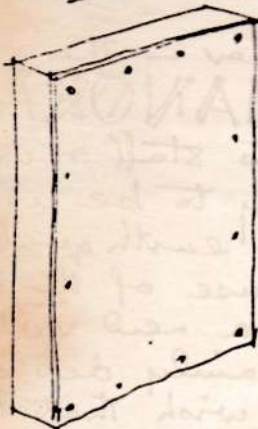
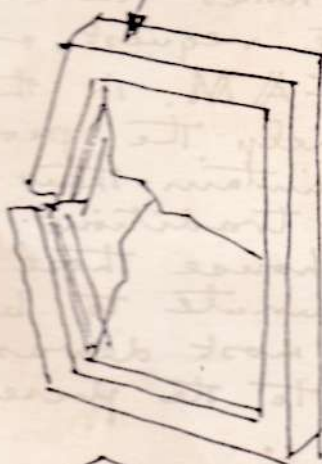
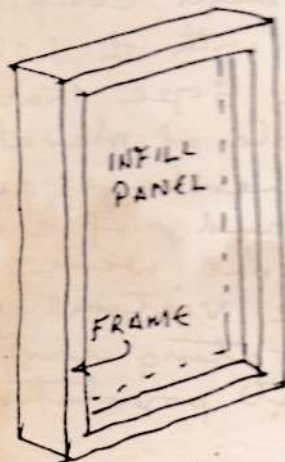
Orientation of roads & houses should be traditional. ~~to~~ make use of wind directions.

Drainage & sewage & waste disposal must be part - an important part of the plan.

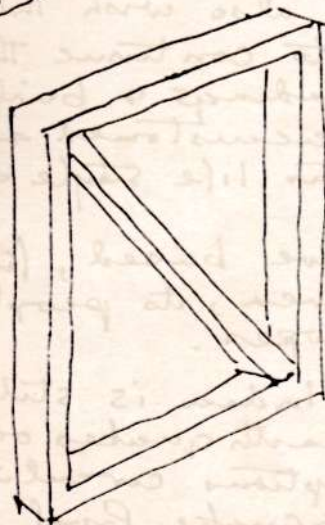
More survey is needed concerning types, sizes, requirements, availability of staff ^{etc} for public buildings such as schools, health centres, anganwadis.

Space for local small scale industries is required.

SIMPLE CLADDING & PANELS



✓



THE FRAME
OR
'STUDDING'

MUST
BE BRACED
DIAGONALLY.

These notes have been compiled at the request, & with the help of OXFAM, in the hope that they will help the people of Marathwada to maintain their heritage and their great traditions and, of course to rehouse those who were unfortunate to be victims of one of the most devastating earthquakes known to the present population of India.

The daily news paper - the **MALAYALA MANORAMA** has received from its staff & its readers a large sum of money to be used for the rehabilitation of the earthquake victims & decided the best use of the money would be to build a new village in place of one of the mainly destroyed villages. They also wish that the people may be able to continue their normal lives in surroundings & buildings to which they are accustomed & which are suitable to their life style & occupations.

So these notes are based, first, on a study of the area, its people, their needs & their hopes.

Unlike Japan, India is still taken by surprise when earthquakes occur and a lot of misconceptions circulate about so-called 'Earthquake Proof' building.

The writer lived for nearly two decades in an earthquake zone & combines his personal experience with known facts & scientific knowledge in this subject & has no other desire than to serve these distressed victims in Marathwada.